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ABOLISH ALL PROHIBITIVE LIQUOR LAWS.

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THE creation of crimes by means of statutes providing for their punishment has generally proved itself bad policy. In the days of Henry VIII it was the maxim that "a tinker was a rogue by statute"; and in Queen Elizabeth's time actors and "stage-players" were put into the same category as tinkers. But it came in time to be understood that the soldering of tin kettles was not a crime because a tinker here and there had robbed a hen-roost, and that the profession which had produced a Shakespeare was not, by any salutary public policy, a criminal profession.

The absolute, unqualified, and distinguished failure of all laws for the abolishment of the traffic in liquors is speedily convincing even the most sanguine prohibitionist of the expediency of wiping them from every statute-book in the land. Their failure has not been so much a protest against interference with the personal liberty of the citizen as an illustration of the venerable maxim that no law can exist without, or can survive, a reason for its existence. These laws, indeed, never had any adequate or logical reason for existing at all. They have had their origins always and without exception in sparsely settled communities where personal liberty was so absolute and unquestioned that it became irksome, where liquor was almost unknown and the user of it a curiosity, and where the only knowledge of the horrors of intoxication the village possessed was derived from itinerant temperance orators who dilated upon the terrible consequences of the rum habit to a roomful of tearful old women, none of whom knew the taste of liquor or of anything stronger than green tea. The early Puritans of New England, who enacted the most ferocious of blue

laws, who would not let a man step over a stone in his path or kiss—not his neighbor's, but his own—wife on a seventh day, no more thought of prohibiting the drinking of liquor than of prohibiting the preaching of eight and ten hours' sermons. When they settled a town, they built, first of all, a meeting house and, next to it, a jail. The jail was for those who did not want to go to the meeting house. But the pint of "new" rum per laborer in the hayfield was as much a matter of course as the minister's madeira or sherry, or the magistrate's metheglin or eggnog or toddy. In the wainscoting around every fireplace was the sunken toddy-shelf to be drawn out of evenings, and when a meeting house was to be raised, the community were expected to drink as freely as Heaven had blessed them in good things or the means to pay for them. So lately as 1804, when the frame of the new meeting house in Brimfield, Mass., was to be raised, the town voted $121.22 for "rum, sugar, brandy, lemons, and wine" for the occasion. And there are but few towns in Massachusetts that are smaller than Brimfield. The Puritans, in their courts of justice, cited edicts and precedents, not from the reporters, but from the Pentateuch, and sent men to the jail or to the gibbet according to the laws of Rehoboam or Jeroboam. But, because the sons of Rechab drank no wine or strong drink, it no more occurred to them to forego wine and strong drink themselves than it did to forsake their substantial frame dwellings and camp out because these same Rechabites had forsworn houses and lived in tents on the plains of Arabia thirty centuries previously!

Liquor is legitimately and logically a subject of excise, and excise laws, which may operate *in rem*—that is, against the thing itself—are proper and constitutional. But it would puzzle writers upon constitutional law to find an origin for laws prohibiting the manufacture or purchase or sale of an article of commerce, though laws regulating all three are neither unconstitutional nor improper. Besides unwritten and written or statute law, there is also what is called the "police power" of a state or a community, that is, the power of keeping the public peace. All three of these jurisdictions may deal with the individual out of whom too much liquor may have made a law-breaker. That is to say, the drunkard has fractured the unwritten or moral law by breaking the rule of temperance in all things. He has broken the written law by becoming a public nuisance or a public charge, and the police power of the State may lay hands upon him and lock him up for being disorderly, or for lying drunk and so blocking up the public streets that orderly persons may not pass and repass. But in what manner or form the commodity we call liquor has broken or come under the penal force of any one of these three jurisdictions, it is difficult to imagine; and, therefore, because this is a hard ques-

tion to answer, it is difficult to find a legal or logical origin for a prohibitory liquor law. Publicists assure us that all salutary laws and statutes which have proved to be for the general good are found to have invariably come from a demand for protection, or for warrant from an individual or a class asking either for protection or for franchise to benefit the state and himself by carrying on some useful business, art, or trade; or they have been enacted for the raising of revenue, or (as I have said above) for the conservation of the public peace. But not of such have been the origins of the various statutes against the selling of liquor which are borne on the statute-books of a great many, indeed of most of, our American States. These laws, when not copied *verbatim* or adopted substantially from other States—as the Kansas law was copied from the Maine law—have originated, not with a class of citizens who asked for protection, but with a class who proposed to protect some other class against its will. I fancy it would be difficult to find a prohibitive liquor law which was not in the first instance proposed by one who was himself either a teetotaler by preference, or one without himself any taste for anything stronger than water, and therefore without the slightest practical experience of the evils of intoxication; or by one whose knowledge of the terrors of liquor-drinking came at second hand from the description of the itinerant "temperance" orator; or possibly by witnessing the effects of the abuse of liquor upon some weaker-minded brother. In other words, it was exactly as if all the persons who preferred to go to bed at nine o'clock should revive the old law of curfew and get it back upon the statute-books; or, as if all those who loved to go to Sunday school should legislate to make it criminal not to go to Sunday school. So far as the records go (and I consult only those published by the prohibitionists themselves), not one single proposition for the policy of prohibiting the sales of liquor has originated from a demand for protection, or from cause of necessity, or even of expediency; or in a locality where the evils of such sales were apparent or largely experienced, or indeed experienced at all. In a rural community, however, absolutely without amusements, where personal liberty resembles, as somebody has well said, "the desolate freedom of the wild ass," and so becomes absolutely irksome—where a man with a theory or a crank with a hobby is welcome as a diversion—it is necessary to burrow in unusual paths for a relaxation. In such a precinct as this, a proposition to forbid somebody something, to prohibit something—it might be the wearing of crinoline or of birds in ladies' hats, or card playing, round dancing, Sunday newspapers, or the eating of animal food—anything, so long as it is something any one enjoys—will become fortuitously popular. Any one of the above would furnish a topic for conversation, a

call for a conference in the meeting house after singing school, might appear in the choice of a selectman, or in the election for the Assembly member, and so speedily become "practical politics," especially in a State where a Governor is chosen every year, and so which lives in a state of perpetual gubernatorial canvass! If laws preventing the sale of liquors should be demanded in a petition of those who used and habitually purchased liquor, but who desired to be relieved from the temptation of purchasing it, a wise public policy might have decreed that the petition prevail. Or, if the best sense of the most enlightened citizens of a community (and it is usually its most enlightened citizens who best appreciate the value and understand the judicious use of liquor) had felt the need of a law prohibiting the sale of cheap and poisonous adulterations of liquor to those who were unable to buy the pure article and whose healths were being deteriorated thereby—in any one of these cases these laws might have wisely been forthcoming, under a general pursuit of the greatest good for the greatest number. But for the non-users and non-purchasers of liquor, finding themselves in a majority, to resolve on their own motion that the minority of their fellow-citizens needed a protection, for which they had not asked, from temptations against which they had not protested, but which were not temptations to the majority, savors rather more of what old Butler characterized as "compounding sins one had a mind to by damning those ones not inclined to," than of legislation for the greatest good of the greatest number; of paternal rather than of popular government!

Once originated, however, the history of the paternal prohibitive liquor law is invariable—namely, its appearance in local politics, then in State politics, and so on, up to the dignity of a balance of power, where the numerical insignificance of the supporters became a tower of strength, and the supporters themselves grew to have fat things at their disposal. The earliest liquor law I can find, for example, grew out of some letters beginning on February 15, 1832, in a local newspaper* in Essex County, Massachusetts; certainly at that time one of the soberest, most law-abiding and church-going communities in the world; whence it was carried by one of the letter-writers, who became a member of the Maine Legislature, into that learned and economic body. If there was a State in our Union of States, at that date almost Arcadian in its innocence, where the foot of the tempter and the setter of snares, or the sybarite, or the debauchee were unknown, that State was Maine! And yet from the immaculate vicinage of Essex County, Massachusetts, to the virtuous State of

* The Salem Gazette.

Maine, the policy of prohibiting that which did not exist, of protecting the few from temptations which had no attractions to the many, flew on the wings of oratory and became fixed by the edicts of legislation. Into the older community, Essex County, it may be feared that Satan has entered! But the sovereign citizen of the State of Maine still lives on, in comic slavery to its prohibitory liquor law—a law indeed marvelous to behold, and a sight for the nations of the earth; alternately sending its citizens to jail for being free men, and rewarding them for becoming slaves! Under the malign influences of the Essex reform the State of Maine has introduced into its economy a new industry, that of the "smeller." Its extraordinary courts and constables and special magistrates, its bailiffs and petty officers who earn salaries on the pretense of enforcing laws which none of themselves, and probably no officers of the State or of its courts, from chief justice to tipstaff, thinks of observing, are legion. Of the published volumes of its reports the bulk are ponderous decisions on and expounding of its peculiar blue laws, which read between the lines like statutes of the Grand Duchy of Gerolstein! And for all this the intelligent citizens of Maine pay the bills and dodge the laws as well as they can! Sixty years or so ago, when the Essex law crawled into Maine, surely, as I have said, it was a virtuous and an Arcadian State. At present, whether it is more temperate than any of its sister States, whether there is less immorality, drunkenness, and crime therein than in any other State in the Union, the citizens of Maine are not fond of expressing an opinion, and doubtless the less said the better! It is to be added, moreover, that the Essex County letter-writers who thus builded better, or worse, than they knew, did not themselves propose a total prohibition from the sale of wines, ales, and other vinous or malt liquor, but one solely from the sale of ardent spirits, and of this only a mild restriction (a sort of "jug law")—that is, that spirits should be sold only to prevent the public drinking in rum-shops and bar-rooms, and the public spectacle of intoxication and brawling which so often resulted (and that what they sought is desirable to-day, as desirable as then, nobody can deny). But the idea that a gentleman who desired to use ardent spirits could not first purchase them, it is simple justice to the writers of the letters to say, did not present itself to them at all. When the matter got into the Maine Legislature, however, whether because the distinction between wines and liquors was too subtle or from other causes, that distinction disappeared. As the pure and simple prohibition of the sale of any liquor, even of domestic manufactured cider, it became a law; the prohibition has since been written into the Constitution of Maine itself, until that State has become a Commonwealth of law-breakers not only but of constitu-

tion-breakers, for the law against selling has become a law against manufacturing, and so against purchasing. And all these laws have been written in the Constitution of the State itself, and the citizens go on buying, selling, and purchasing, with a pretense of surreptitiousness that, comic as it all is, keeps buyer, seller, retailer, and purchaser alike in breach of the statutes *in sæcula sæculorum!*

But, from whatever source or sources ingrafted upon a long-suffering community, no honest student of these laws can deny that they have had one of three effects, if not all three of them —namely, (1) to increase the demand for, while deteriorating the quality of, the supply of liquors; (2) to stimulate the ingenuity of the subject in evading the law itself, if not to produce the appetite for liquor drinking where it existed not before; or (3) to give to the visionary or "crank" class in a community political balance of power—that is, an absolute even if a temporary power. In other words, prohibitory liquor laws are dangerous to the physical, moral, and political health of a community: to the physical health, by inducing venders who can not afford to sell pure liquor at the risk of the penalty, but who can not well resist the temptation in view of the enormous profits of selling cheap and vile mixtures at the enhanced prices for pure liquor, to keep their poisons on sale; to the moral health, by making honest men law-breakers (with the dangerous tendency of the law-breaker *in petto* toward law-breaking *in extenso*, which the writers of moral poetry, from Dr. Watts up, have versified about until the memory of man runneth not to the contrary); and to the political health, by putting power into the hands of dangerous classes, the theorists, the "cranks," and the people with "missions" and visions as to reforming the world! (It might be added, perhaps, that these laws offend the religious sense, for in some States, as in Maine and in Kansas, the use of wine for the sacrament has been held a violation of law. But this aspect we are not at present discussing.) And all this in addition to the fact that prohibitory liquor laws are, always and everywhere, an infringement of the liberty of the subject, in opposition to the inalienable rights of life, liberty, and the pursuit of happiness which it is the business of constitutions to decree and of States to secure.

Drunkenness is a crime in itself and the fruitful mother of other crimes, and with it the criminal law should deal. But no commercial law or municipal law, no form of civil (as distinguished from criminal) law has anything to do with crimes. The legal maxim, as old as civilization, that one must so use his own as not to injure his neighbor, takes ample care of the liquor-seller who sells liquor to one who he knows will do violence or wrong under its influence. Let the criminal law, then, attend to

the case of the drunkard and of the rumseller who will knowingly make his feeble or hereditarily weak fellow-man a drunkard. But as there is no commandment in the decalogue, "Thou shalt not sell liquor," it is not in the unwritten law, and so can not justly, equitably, or legally be put into written law. That it is ever put there means some ulterior object, or if not an ulterior object always, certainly always it means, because it always has, an ulterior effect.

But prohibitory liquor laws have still another and ulterior effect, to wit: They beget an exaggerated oratory and an appetite for sweeping statements which, by the cultivation of false statistics, becomes absolute dishonesty, and so a burden upon and a reproach to public morals. For it is quite as heinous a sin, in the court of conscience, to lie about the number of persons who have died from using liquor as it is to lie about the amount of one's collections for charity, as did Ananias, or about the value of one's farm to the autumnal assessor. And yet another, more of an economical than a moral consequence, perhaps, might be catalogued. It has become in some communities practically impossible to discuss certain important questions. For example, it is to-day practically impossible in many quarters of this fair land to discuss so important a question as the effect of alcoholic liquors upon the human system. Impossible, I say, for no sooner is such a question broached than the most tropical statements, backed by the glassy fascination of enormous round numbers, would be hurled at the general public until the modest man of science, and science itself, are put to rout. This writer himself heard, in the Columbian year and from a Columbian orator, the following masterpiece of statement, to wit: "The champions of slavery, having declared their purpose to shatter the Union, withdrew from Washington and opened fire from without. Not so the liquor power. It plants its cannon, charged with hell's dynamite (enough of them to stretch in a line from this spot to the homes, the churches, the schools of the people); and there, sheltered and protected by the strong arm of the Government, the work of destruction goes mightily on among Americans; every five years there is an array of dead as a consequence equal in number to those killed on both sides in the civil war." By a coincidence, these words were uttered at a time when the courts of the State of New York had been several months, and at an expense of several hundred thousand dollars' worth of high-priced expert testimony, trying to ascertain whether Mrs. Carlyle Harris died of morphine poisoning, and was beginning to make an equal outlay to find if Mrs. Dr. Buchanan had died from the effect of morphine or atropine. And yet, here and meanwhile, this glowing orator announced that not one more nor one less than a million human beings had, in the

five years past, perished from being poisoned by liquor—by alcohol, an extremely mild toxicant that in some form or other chemists tell us exists in almost all our food, solid or liquid! Did it not, perhaps, occur to the orator, or possibly to another of his audience besides the present writer, that in the million of cases assured, say in two or three, even in one of them, a latent or contributing cause might possibly have mitigated the responsibility of this murderous alcohol; that one of those million of men may have been, perhaps, indiscreet in something else besides drinking beer, or had somewhere latent in his system some congenital or local contributive cause; or perhaps had met with some accidental incident to his alleged untimely taking off?

But this is a single sample only of the intemperance, not to say the voluptuous dalliance with tropical statistics, of the prohibition orator, who asserts that liquor has slain more than wild beasts, than wars, pestilences, famines and even deluges and Johnstown floods (which latter, by the way, were bursts of water and not of alcohol, which therefore has not, even in the mouths of prohibition orators, achieved the record of water, which certainly did wreck Johnstown, and which, according to Holy Writ, in one case did actually destroy the whole world). Indeed, nothing is more common upon their lips than the maxim "Liquor destroys both body and soul." But if the annual deaths actually and beyond question traceable to liquor were arrayed against the annual mortality (which is said to be a constant figure indifferently as to wars, famines, tidal waves, and the like cataclysma), it might be disputed as above if liquor always destroys the body, while as to the soul what mortal can depose and say? The danger of the tropical statement which appears to be inseparable from prohibition politics, however, is a very great one. Falsehood is falsehood and lying is lying, even in the mouths of lecturers and reformers; and temperance is a cardinal virtue in speech as well as in liquor drinking. Were such opulent misrepresentation and dishonesty confined only to the so-called "temperance" orators or "reformers," it would be bad enough, as teaching looseness and unreliability of statement and an irresponsibility of language, which would be and is dangerous to any community at large. But not only the tramp and the circulating itinerant, but eminent men, men of brains and personal worth, whose influence for good in their own neighborhood might be very large, are often so warped in their very fiber by this sort of misfortune as to become incapable of seeing things as they are—dealers in untruth, wrapped in untruth as in a garment. I have in mind one eminent gentleman, a man of large affairs and of otherwise unblemished integrity, who has the misfortune of being a prohibitionist leader, and

the author and supporter of many prohibitionist statutes. As the standing chairman of a committee in the Legislature of a certain State to report annually as to the value and the operation of these statutes, his reports are invariably enthusiastic as to their great value, as to their effect in closing liquor stores, and in making drunkenness almost unknown. And this in the teeth of the facts, which everybody else admits, that these statutes are stupendous failures, that they have multiplied the number of liquor shops, and added to whatever harm they are capable of by disguising them as "pharmacies," "groceries," or other sorts of shops, and that they have enormously increased, almost squared, the number of inebriates reported before their passage! Nobody impeaches or dreams of impeaching the statements of this dear old gentleman, nameless here for evermore, who, foolish and fond and lovingly proud of his statutes, can see nothing but utility and salvation in them! But, all the same, it is an actual wrong, and in time it will be surely an actual damage to the Commonwealth that its intelligent citizens can so deliberately misstate facts. If its best citizens can not tell the truth on public matters, what can the Commonwealth expect of its masses?

But everybody knows that drunkenness is a curse, and if we abolish all prohibitive liquor laws how shall the curse be removed? To enact a law compelling every man, woman, and child to drink a pint of whisky—or its equivalent in other spirits, or in vinous, or malt liquors—daily, might indeed do it. But such a law would probably be impossible to propose in a legislative body—certainly impossible to pass to a final reading. The question can not probably be answered at present. Most things, however, have their limit of value. And it might be a question whether even the soul of a drunkard were worth saving at the expense of the liberty, the morals, and the health of an entire community. But something very near to an answer can, I think, be approximated. Let us enforce the common law we have, and make it "common" indeed; and forbear to pass statutes against which the sense of justice of the enlightened community rebels, and which can not be enforced, or whose enforcement is only, and can in the nature of things be only, a sham. Let us wipe out forever from every statute-book in America those prohibitive liquor laws which an experience of sixty years has proved to be worse than worthless, and even worse than useless, because they not only can not be enforced, but enlarge, by stimulating, the alleged evils they pretend to abolish! These laws emphatically have not lessened the manufacture, sale, or consumption of liquor. There are not to-day ten times as many people in the country as there were on January 15, 1832. But, unless figures are as unreliable as the temperance orators themselves, there are many hundred times as

many liquor stores and shops for the public drinking of liquor in our fair land as there were upon that date. Various causes have doubtless operated to produce this enormous increase. But one cause which may have done its contributive share toward the result, perhaps, is that, under rigid statutes, any moral obligation not to use liquor which may have existed on January 15, 1832, has become a sort of moral obligation to use it as a sort of Declaration of Independence of laws which interfere with the personal liberty of the subject; which exist not by consent of those whom those laws govern, but by the consent of those whom they do not govern, and who never come within their operation; whose prosecution, since it can only be achieved by recourse to the services of the spy, the informer, and the "smeller," is persecution, and tends to bring all law into contempt and into public disgust.

That these laws do exist by reason of the judgments of appellate courts (even the Supreme Court of the United States having affirmed their "constitutionality") is not to militate against their injustice or their inconvenience. Those decisions are not as to the expediency, but only as to the technicality, of these statutes; all that those decisions amount to is that as between the individual —the citizen—in their breach, and the State, the State has a right to enact the law under its special (State) Constitution, and that the question of internal traffic—so long as it is not interstate traffic—is not one with which the Federal jurisdiction concerns itself. Legally a State has a right to do what it will within its own boundaries, so long as it does not interfere with the rights of its neighboring States or violate the Federal Constitution. And however absurd its local statutes may be, once legally enacted they must be reviewed at the polls, not in the Federal courts. But there is a question beyond the polls.

Laws are for the greatest good of the greatest number, at least in republics, where the paternal jurisdiction of States is not invited and will not be tolerated. Granting everything that can be said as to the bad effect of liquor itself, every logician will admit that if it can be proved that in a single instance or class of instances the effect of liquor is salutary, that it cures as well as kills (as, for example, in a case of partial drowning or of rattlesnake bite), then to prevent its sale is not only illogical but oppressive. A law can not be judged as benign or harmful accordingly as it is negatively inoffensive. If in a single instance it refuses to save life, then it has ceased to operate benignly and has commenced to operate fatally. No law can exist without a reason for its existence, and when the reason for it fails the law disappears. But when a law operates not only unreasonably but fatally, there should not be much hesitation as to its doom. It is illegal. And this is another case where liquor

laws are dangerous to the community—namely, they might prevent the purchase of enough liquor to save a human life. As it is, there are rural communities, not a thousand miles from the metropolis of New England, where the apothecary will refuse (and in my own experience has refused) to sell the mother of a sick child enough alcohol to light a spirit lamp to warm the little sufferer's sustenance on a summer night at a strange hotel, where no other artificial heat could be procured! This same apothecary could sell Paris green by the pound for the destruction of alleged potato bugs, or morphine, or arsenic, or any other poison on presentation of a scrap of paper beginning with an "℞," and signed by any scrawl which the writer might choose to affix, and call it the signature of a physician. Our apothecary that night was illogical and dangerous to the community, not by instinct or by choice, but by the virtue of the laws of his State—by the laws, as it happened in the case I have in mind, of the noble old Commonwealth of Massachusetts!

But we have not closed the catalogue yet; there is still another, and this by no means a slight, evil, which is caused to the community by prohibitive liquor laws, which might be called, perhaps, the intellectual evil which they work. This is the begetting of the very general horror of wines, spirits, malt liquors, and other drinkables of more or less vinous character, which is allowed to prevail, not only, but is sedulously and perpetually cultivated in certain communities, until very young people are apt to consider themselves as virtuous paragons surrounded by alcoholic demons seeking their destruction, whose fault, and not their own, it will be if they tumble. This idea and sentiment are enormously prevalent, thanks to those industrious people the "temperance" reformers (though they insult one of the cardinal virtues by so calling themselves). I can indeed instance no severer proof of it than to narrate that, having been so fortunate, in the case of some special investigation then on hand, as to unearth the diary kept by an officer of the Revolution during the march of Arnold's and Wooster's commands through the snows of the terrible winter of 1775–'76 to relieve the army in Canada, and the subsequent retreat in rags, hunger, freezing, and wretchedness, I intrusted its copying to a worthy lady, a descendant of the officer who kept the diary. In due time she returned the copy, but wrote me, "I have omitted all references to brandy and eggnog, as not part of our country's history." And yet to me, and I fancy most of us, it was "history"—ay, and the "history of our country" too! How those patriots lived through and managed to survive at all the terrors of that winter, certainly was history; and I for one am thankful that, at least, if there was no food betimes, there were brandy, and an occasional egg-

nog, for those sturdy and starving patriots! But this worthy lady lived in rural New England, and had been taught from her youth of the terrors and misery that lay hidden—not for fools only, but for everybody—in a bottle! And she could not see that God's gifts to men sometimes have come to his perishing creatures in the liquor form. The public inconvenience of this belief is not inconsiderable. Not only are its citizens deprived of the sanitary potency of liquor in emergencies (for I have heard apparently sane persons, in a village not a thousand miles from the city of New York, declare that they would rather die than have their lives saved by a glass of liquor), but the youths are taught, not to be virtuous and sober, and to shun drunkenness, but to persecute liquor sellers and to waste liquor by emptying it into the gutters: that the unfortunate who drinks himself into imbecility, or into becoming a public nuisance, is not a criminal or a lawbreaker, but an example of the wickedness of the hotel keeper—and so not the sinner but the sinned against! Not he to be disciplined or chided, but the innocent liquor is to be cursed, and the liquor dealer to be deprived of his property! It would appear to most of us that to preach a little less about the holy horror of rum, and a little more about the political obligation of the citizen to keep himself from drunkenness—to notify him that the law locks up the wretched drunkard, not because he is not a citizen who can not drink if he please, and not because liquor is a sinful thing, or because his neighbor has no right to invest his capital, if so pleased, in hogsheads of liquor and to retail it by the glass or spoonful, but because he is drunk, and because a drunkard is a nuisance and a threat to the community—would be an experiment worth the trying. Another experiment would be to rely upon such an administration of what laws we have as will encourage temperance by punishing the drunkard, not the liquor which he drinks or the manufacturer or the seller of it, nor yet the community whose misfortune and for whose sins it is that the drunkard is a part of it. We can not reclaim our wayward youth by sending their parents to Sunday school; we can not rid the community of drunkards by refusing to sell liquor to the sober man. But it requires no statute to refuse to sell it to the debauchee. This land of ours is ruled by law. The trend of progress is toward a larger and a more enlightened, not a lesser and more ignorant liberty; and civilizations move not backward. In the calm eye of the law, the owner of pipes of liquor is as much entitled to his own as is the owner of a "temperance" newspaper, as long as he injures not his neighbor. He of the wine pipes must not sell to the habitual drunkard, or to the hereditary victim of alcoholism who works damage in his cups; neither shall he of the printing press libel in words him of the wine pipes, or invite

his fellow-citizens to violence against him or destruction of his worldly goods. For over one and all is the law of the land. Let our youth learn this, and not that others have obligations and stand at their peril, while he alone is free, if he only will sign a pledge and wear a blue ribbon!

In still another way the prohibitive liquor laws have worked, and are still working, hardship to our people. The liquor-drinking habit in large and metropolitan cities is palpably on the decline. Here the ever-increasing complexity of affairs, the immense demand of competition, the necessity of care and vigilance lest one be outrun in the race for success, and the strain of business methods, render it injudicious to drink much wine or liquor; large corporations exact a rigid temperance, often total abstinence, from their officials and employees. Either because edicts of fashion for once have followed the demands of business, or for some other cause it appears to be absolutely no longer fashionable in cities to drink deep or long at table. In the natural course there is reason to believe that this fashion might reach the interior, to prevail there. But, in the towns and cities of the liquor-law-ridden States, the more stringent the ordinances, and the more important and bustling the "smeller," it more and more becomes a point of self-respect, almost of honor, between man and man, to drink much and often, and liquor drinking increases daily. Even lads of tender years, clubbing together, buying a demijohn of what purports to be something of which they have heard their elders speak, and hiding in some cellar or bedroom, experience all the fearful joys of dissipation! In other interior precincts where there never was much liquor drinking, but where the itinerant reformer stands in lieu of lyceum or theater or assembly, the liquor habit will remain about the same, not increasing, but not allowed by the reformers to die out and their occupation be gone. So the maxim of Horace Greeley, that a habitual drunkard is quite as useful a member of society as a temperance reformer, remains unerringly true, not only, but he is positively a retarder of public progress. But once let every liquor law be expunged from the statute-books of our American States and the temperance reformer would disappear, the benign influences of the city would spread to the country, liquor drinking being no longer a matter of courtesy or self-respect, but an indifferent matter of taste, would decrease, as it always has decreased in the civilized communities when let alone and to itself. The horror of liquor would disappear, and only the horror of the drunkard would remain. And the enormous gain would not only be the salvage of the money wasted in pretending to enforce incompetent and disrespected laws, but in behalf of public morality, because with no sumptuary laws to break, there would be no

decent and honorable citizens turned into law-breakers; no personal and paternal statutes to evade, and so no statute evaders.

But until we wipe out all these present restrictive liquor laws we can not hate the drunkard. We must be charitable with him, even cherish as well as pity him; we must even respect him as a man who is upholding the liberty of the subject at the expense of his health; as a sort of public martyr. We must reverse many a popular maxim in his behalf. Instead of "Drunkenness leads to poverty," or "Drunkenness leads to wretchedness," we must read it "Poverty leads to drunkenness," "Wretchedness leads to drunkenness." Instead of worrying lest the horrible inebriate go home and brain his family and smash his furniture, we must cry, "Poor man, he is out of employment," "Poor man, he has an unhappy home, a shrewish wife and bad children, and there was nothing left him but drink," "It is not his fault, it is the fault of that horrid liquor seller." And so on, as if the selling of liquor and not the besotting of one's self with liquor, were the crime; as if the seller and not the drinker were the criminal; as if one who would not drink could be made a drunkard by the selling of liquor; or as if the fruits of the earth expressed or distilled were unholy and abhorred, when in any other form they were God's best gifts to man.

Like most admirable servants, liquor is apt to be a bad master if allowed the upper hand or permitted to get into politics. But there are many persons, not habitual drunkards themselves, who actually believe that malarious and impure water is a circulator of disease, but can be disarmed and rendered safe by the dilution with whisky. The boards of health of cities (New York city, for example), in their printed directions to the public for the prevention of cholera, advise that the water given to infants and very young children in the heated season be diluted with a few drops of whisky. But liquor laws are legislation, not against sick babies, but against the few drops of whisky which might save their little lives, and if the poor parents can not afford to pay a physician for a slip of paper giving the Latin name of whisky, the poor baby must die, or run the risk of death, by drinking malarious water. If there is any such thing as a salutary liquor law, not derived from excise or police jurisdiction, it would be perhaps a statute insuring the purity of liquor; reviving that old English functionary, the "ale-taster," with his care over all drinkables publicly offered for sale. This would be a legitimate and a constitutional law, as providing for the public safety (which is, after all is said, the origin and the summit of all laws). There is no greater charm to the tourist in rural England than the certainty that, no matter how small the village through which he passes, he will find at the inn refreshment and comfort, "eatable

things to eat and drinkable things to drink." Indeed, the ale-taster was once a public benefactor and more important than the mayor, and such was his benign influence that old Harrison, writing in the sixteenth century, declared that the glory of England was her inns. The roads might be rough and full of highwaymen, but at any inn the traveler could take his ease and be sure he would not be poisoned. For four hundred years it has been possible to enter an inn in the smallest and most insignificant rural hamlet in England and get a thimbleful of liquor without peril to one's stomach or to one's self-respect. How is it in those of the United States which prohibit the sale of liquor? As to one's stomach, I merely copy an item from a local newspaper printed in one of those States (suppressing the localities only):

"Some recent cases of poisoning hereabouts have brought out the statement that poor whisky is abundant in this city. It is sold principally in the kitchen dives and in places on the outskirts. Some of the whisky, it is said, has been so poor that wholesale dealers have disclaimed all knowledge of having sold it. Some of the unlicensed dealers have been selling 'whisky,' but where obtained it has been one of the mysteries that are impossible to explain. With the poisoning of the three men on Sunday night and the investigations which have followed, some light has been shed upon the subject."

"It was stated in these columns on Monday that there had been a man about selling a receipt for making whisky. Investigation proves that this is so, but it is impossible to find a liquor dealer who will say he purchased it for five dollars—the price asked. This receipt as near as can be ascertained is as follows: One drachm of oil of vitriol or sulphuric acid, six drachms of spirits of turpentine, three drachms of spirits of juniper, six drachms of oil of almonds, and a quart of elderberry wine; a seductive decoction indeed. These fluids diluted with twenty-four gallons of water will make about twenty-five gallons of whisky, and cost in the neighborhood of one dollar and twenty-five cents, while the same quantity of distilled whisky would cost from forty to seventy-five dollars. Just how much of a business this man has conducted in ——— is not known, but that he has been favored with a fairly good trade is not doubted by the regular wholesale liquor dealers. He has been all through the villages in the ——— and has also been to ———."

So much for the visitor's stomach; now for his self-respect! As a native of the State most strenuous in its policy of prohibiting the sales of liquor, I have been now and again a curious collector of the divers and sundry ruses resorted to in evasion of the statutes by its best citizens, and I am able to note the latest as experienced during the present summer. At a certain watering-place hotel within its paternal jurisdiction, guests who desired wine at dinner, or stimulants at other times, were invited to purchase a keg of an interesting compound known as root beer. A price for this alleged keg was charged to them on their hotel bill, and they were at liberty to visit the wine room, or to order from the waiters any liquors desired, until this price was exhausted,

when another keg of root beer was charged to them, and so on! This, of course, is only one of hundreds of such devices, which are the rule and not the exception in the liquor-prohibiting States. And I beg to ask, what respect a State can expect its citizens to have for its laws, or for themselves, when forced to habitually resort to a deceit which deceives nobody, in order to live as they see fit and as they have an inalienable right to live?

Liquor has always properly been, and always properly will be, a subject of revenue, or, as it is called, excise, and this excise is most conveniently levied in the shape of licenses. Of licenses, high and low, high license is doubtless the best for all concerned, as providing cleaner and more sumptuously appointed drinking places, with that modulation and betterment of manners and of speech to which elegance of surroundings will always conduce. But prohibitive liquor laws should be discontinued, because sixty years of certainly faithful trial have shown them to be failures, dangerous to the public peace, the public health, and the public morals; against public policy as tending to bring all reasonable laws into bad repute, and against absolute right as an interference of the law merchant with the jurisdiction of the criminal law; enacted, as criminal laws are enacted, by those who are not supposed to come under their operation.

Much of what has been said of prohibitory liquor laws in this paper might also be said of the usury laws,* which are of the family of crime-creating statutes, which are always readily evaded and which interfere with the market value of the commodity protected. But there is this difference, that usury laws are demanded by the protected class, while prohibitive liquor laws are not, and never can be.

Admitting freely all that can be said about the horrors which liquor can work, sociologists as well as Samaritans know that no public evil can be dealt with abstractly—dragged up by the roots and exterminated in a single swoop of virtue. Sinful as the liquor industry may be, its absolute and sudden annihilation would throw millions out of employment, and put starvation into the room of competence in countless homes, to remain until, by the slow labor of economists and publicists, capital and labor had readjusted themselves to the new condition. And the literal interpretation of statutes at present upon the statute-books of certain American States would send fathers of families to State prisons to serve out terms of sixty or a hundred years—under cumulative sentences which more than cover the natural lives of men. Fortunately, however, the drinking of liquor does not de-

* In Queen Elizabeth's time the analogy was still more perfect, for the price of liquor was regulated as the price of money now is sought to be by usury laws—by statute.

stroy either the body or the soul. The best evidence obtainable by medical industry intimates that, while, as everybody knows, the temperate outlive all other classes, even the habitually intoxicated man may, and does, outlive the rigid and inexorable total abstainer who refuses to his organism the stimulant which overworked or overstrung human systems sometimes insist upon.*

I do not know what evidence can be subpœnaed as to the loss of souls. But, admitting the occasional loss of a soul, the question might arise as to whether a soul could not be saved at too high a price. Should an entire community like the State of Vermont, or of Maine, or of Kansas, or like Boston, or the city of New York, for example, imperil its sanitary existence to save any one given human soul? Or how large or how small a community should be allotted to peril *per* soul? It requires a strong stomach and a tranquil nervous system to absorb ice water, and dyspeptics and excitable persons are not always deserving of death at the hands of the State.

I know that the easy-going humanitarian answer to this is, that all prohibitive liquor policies carry within themselves the seeds of their own dissolution, since they are only agitated in sparsely settled localities, from which, as populations thicken there, they gently disappear.† But, meantime, if the traffic in liquor is dangerous, these policies are working an enormous harm to the communities where they are tolerated. All history proves that there is no institution or system in the world which it has ever been attempted to stifle by legislation which is not to-day as fixed and immutable as the hills. The efforts of the English Puritans to abolish the theater made theatrical performances parcel of English civilization. The attempts of the middle ages, the Inquisition, and the Index, to destroy the printing press made the printing press a necessity of life everywhere. If liquor is dangerous to the United States of America, philanthropists and patriots should be careful how they pass laws against it!

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* I believe the figures are claimed to be as follows: Out of 4,234 cases of mortality from ordinary causes, the lengths of life were:

Temperate livers	62·13 years.
Careless drinkers	59·67 "
Free drinkers	57·59 "
Habitually intemperate	52·03 "
Total abstainers	51·22 "

According to a recent report of the British Medical Association, in their journal in the year 1891.

† The little town of Westfield, N. J., has two or three active prohibition societies, and I am told that all the churches (except the Roman Catholic and the Episcopal) preach prohibition from their pulpits. Ten years ago, with a population of two thousand, the town cast three hundred prohibition votes; last year, with a population of thirty-seven hundred, as I am informed, it cast just fourteen!

INDUSTRIES OF ANIMALS.*

By FRÉDÉRIC HOUSSAY.

WE find among animals not only hunting and fishing but the art of storing in barns, of domesticating various species, of harvesting and reaping—the rudiments of the chief human industries. Certain animals in order to shelter themselves take advantage of natural caverns in the same way as many races of primitive men. Others, like the fox and the rodents, dig out dwellings in the earth; even to-day there are regions where man does not act otherwise, preparing himself a lodging by excavations in the chalk or the tufa. Woven dwellings, constructed with materials entangled in one another, like the nests of birds, proceed from the same method of manufacture as the woolen stuffs of which nomad tribes make their tents. The termites who construct vast dwellings of clay, the beavers who build huts of wood and of mud, have in this industry reached the same point as man. They do not build so well, no doubt, nor in so complex a fashion as modern architects and engineers, but they work in the same way. All these ingenious artisans operate without organs specially adapted to accomplish the effect which they reach. It is with such genuine industries that we have to deal, for the most part neglecting other productions, more marvelous in certain ways, which are formed by particular organs, or are elaborated within the organism, and are not the result of the intelligent effort of the individual. To this category belong the threads which the spider stretches, and the cocoon with which the caterpillar surrounds himself to shelter his metamorphosis.

STRUGGLES OF THE CHASE.—It is not always sufficient for the hunter to find game and to reach it. If the game is of large size it may be able to hold its own, and the pursuit may end in a violent struggle, in which both skill and cunning are necessary to obtain conquest.

The bird which displays the most remarkable qualities in this struggle which terminates the chase, exhibiting indeed a real fencing match, is the secretary bird (*Gypogeranus reptilivorus*, Fig. 1). He is the more interested in striking without being himself struck, since the fangs with which his prey, the snake, is generally armed might at the first blow give him a mortal wound. In South Africa he pursues every snake, even the most venomous. Warned by instinct of the terrible enemy he has met, the reptile at first seeks safety in flight; the secretary follows him on foot,

* An abstract from the author's book under this title in The Contemporary Science Series. Imported by Messrs. Charles Scribner's Sons, New York.

and the ardor of the chase does not prevent him from being constantly on guard. This is because the snake, finding himself nearly overtaken, suddenly turns round, ready to use his defensive weapons. The bird stops, and turns in one of his wings to protect the lower parts of his body. A real duel then begins. The snake throws himself on his enemy, who at each stroke parries with the end of his wing; the fangs are buried in the great feathers which terminate it, and there leave their poison without producing any effect. All this time with the other wing the secretary repeatedly strikes the reptile, who is at last stunned, and

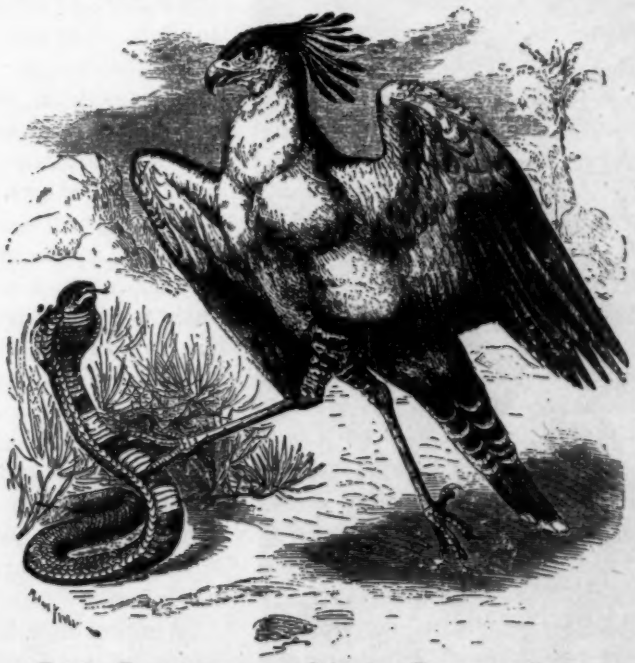

FIG. 1.—FIGHT BETWEEN THE SECRETARY BIRD AND A SNAKE.

rolls over on the earth. The conqueror rapidly thrusts his beak into his skull, throws his victim into the air, and swallows him.

HUNTING WITH PROJECTILES.—It has often been repeated that man is the only creature sufficiently intelligent to utilize as weapons exterior objects like a stone or a stick; in a much greater degree, therefore, it was said, was he the only creature capable of striking from afar with a projectile. Nevertheless, creatures so inferior as fish exhibit extreme skill in the art of reaching their prey at a distance. Several act in this way. There is first the *Toxotes iaculator*, which lives in the rivers of India. His principal food is formed by the insects who wander over the leaves of aquatic plants. To wait until they fell into the water would naturally result in but meager fare. To leap at them with one bound is

difficult, not to mention that the noise would cause them to flee. The *Toxotes* knows a better trick than that. He draws in some drops of water, and, contracting his mouth, projects them with so much force and certainty that they rarely fail to reach the chosen aim, and to bring into the water all the insects he desires (Fig. 2). Other animals also squirt various liquids, sometimes in attack, but more especially in defense. The cephalopods, for example, emit their ink, which darkens the water and allows them to flee. Certain insects exude bitter or fetid liquids; but in all these cases, and in others that are similar, the animal finds in his own organism a secretion which happens to be more or less useful to his conservation. The method of the *Toxotes* is different. It is a foreign body which he takes up, and it is an intended victim at which he takes aim and which he strikes; his movements are admirably coordinated to obtain a precise effect.

FIG. 2.—THE TOXOTES THROWING WATER AT INSECTS.

Another fish, the *Chelinous* of Java, also acts in this manner. He generally lives in estuaries. It is therefore a brackish water which he takes up and projects by closing his gills and contracting his mouth; he can thus strike a fly at a distance of several feet. Usually he aims sufficiently well to strike it at the first blow, but sometimes he fails. Then he begins again until he has succeeded, which shows that his movements are not those of a machine.

METHODS OF UTILIZING THE CAPTURED GAME.—Frequently it is not enough for the animal to obtain possession of his prey. Before making his meal it is still necessary to find a method of making use of it, either because the eatable parts are buried in a thick shell which he is unable to break; or because he has captured a creature which rolls itself into a ball and bristles its plumes.

Here are some of the more curious practices followed in such cases.

Sometimes it is a question of carrying off a round fruit which offers no prominence to take hold of. The red-headed woodpecker (*Melanerpes erythrocephalus*) of North America is very greedy with regard to apples, and feeds on them as well as on cherries. It takes him a considerable time to consume an apple, and as he is well aware of the danger he runs by prolonging his stay in an orchard, he wishes to carry away his booty to a safe and sheltered spot. He vigorously plunges his open beak into the apple; the two mandibles enter separately, and the fruit is well fixed; he detaches it and flies away to the chosen retreat.

The combination is complicated, and approaches more nearly the methods employed by man, when the animal makes use of a foreign body, as a tool or as a fulcrum, to achieve his objects. A snake is very embarrassed when he has swallowed an entire egg with the shell; he can not digest it in that condition, and the muscles of his stomach are not strong enough to break it. The snake often finds himself in this condition, and is then accustomed either

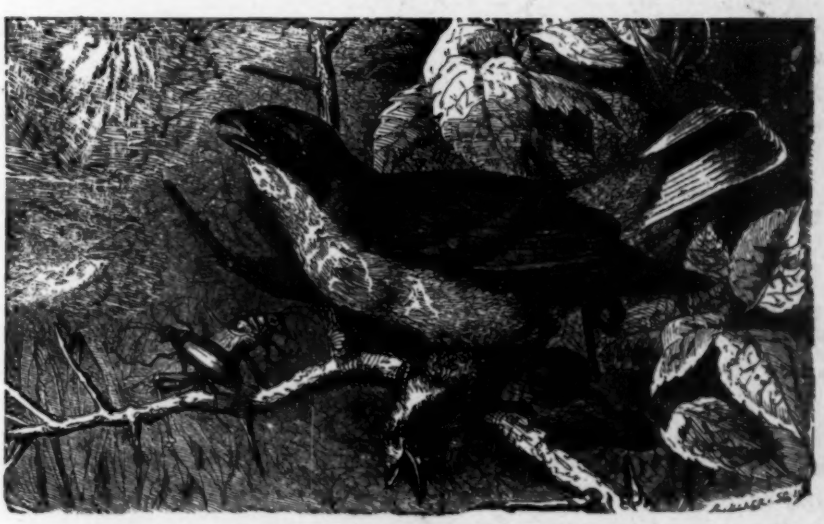

FIG. 3.—THE LANIUS STOCKING ITS LARDER.

to strike his body against hard objects or to coil himself around them until he has broken the envelope of the egg he contains.

Neither the beak nor the claws of the shrike or butcher bird (*Lanius excubitor*) are strong enough to enable him to tear his prey easily. When he is not too driven by hunger he installs himself in a comfortable fashion for this carving process, places on a thorn or on a pointed branch the victim he has made, and when it is thus fixed easily devours it in threads.

The *Lanius collurio*, an allied bird, uses this method still more frequently. He even prepares a small larder before feasting. One may thus see on a thorny branch spitted side by side Coleoptera, crickets, grasshoppers, frogs, and even young birds, which he has seized when they were in flight. (Fig. 3.)

Of all these well-attested facts that which perhaps best shows how animals in certain circumstances may take advantage of a foreign body to utilize the product of the chase is the following, the observation of which is due to Parseval-Deschênes. He followed during several hours an ant bearing a heavy burden. On arriving at the foot of a little hillock the animal was unable to mount with his load, and abandoned it—a very extraordinary fact for one who knows the inconceivable tenacity of insects. The abandonment, therefore, left hope of return. The ant at last met one of his companions, who was also carrying a burden. They stopped, took counsel for an instant, bringing their antennæ together, and started for the hillock. The second ant then left his burden, and both together seized a twig and introduced its end beneath the first load which had been abandoned because of its weight. By acting on the free extremity of the twig they were able to use it exactly as a lever, and succeeded almost without trouble in passing their booty on to the other side of the little hillock. It seems to me that these ants who invented the lever are worthy of admiration, and that their ingenuity does not yield to our own.

Animals construct dwellings either to protect themselves from the cold, heat, rain, and other chances of the weather, or to retire to at moments when the search for food does not compel them to be outside and exposed to the attacks of enemies. Some inhabit these refuges permanently; others only remain there during the winter; others, again, who live during the rest of the year in the open air, set up dwellings to bring forth their young, or to lay their eggs and rear the offspring. Whatever the object may be for which these retreats are built, they constitute altogether various manifestations of the same industry, and I will class them, not according to the uses which they are to serve, but according to the amount of art displayed by the architect.

Dwellings formed of Coarsely Entangled Materials.—Diurnal birds of prey are the first animals who practice skillfully the twining of materials. Their nests, which have received the name of eyries, are not yet masterpieces of architecture, and reveal the beginning of the industry which is pushed so far by other birds. Usually situated in wild and inaccessible spots, the young are there in safety when their parents are away on distant expeditions. The abrupt summits of cliffs and the tops of the highest forest trees are the favorite spots chosen by the great

birds of prey. The eyrie generally consists of a mass of dry branches which cross and mutually support one another, constituting a whole which is fairly resistant.

Even these primitive nests are not, however, without more complicated details of interest. Thus Mr. Denis Gale wrote to

FIG. 4.—THE STICKLEBACK AND ITS NEST.

Bendire concerning the golden eagle in America: "Here in Colorado, in the numerous glades running from the valleys into the foothills, high, inaccessible ledges are quite frequently met with which afford the eagles secure sites for their enormous nests. I know of one nest that must contain two wagon-loads of material. It is over seven feet high, and quite six feet wide on its upper sur-

face. In most cases the cliff above overhangs the site. At the end of February or the beginning of March the needful repairs to the nest are attended to, and the universal branch of evergreen is laid upon the nest, seemingly for any purpose save that of utility. This feature has been present in all the nests I have examined myself, or have had examined by others; it would seem to be employed as a badge of occupancy."

It is scarcely necessary to recall the skillful art with which the stickleback, which inhabits all our streams, plaits its nest and remains sentinel near it. (Fig. 4.) This fish has indeed monopolized our admiration, and is considered as the most skillful if not the only aquatic architect. Yet, besides those which I have already mentioned, there is one which equals the stickleback in the skill it displays in constructing a shelter for its spawn. This is the *Gobius niger*, met on our coasts, especially in the estuaries of rivers. The male interlaces and weaves the leaves of algæ, etc., and when he has finished his preparations he goes to seek females, and leads them one by one to lay in the retreat he has built. Then he remains in the neighborhood until the young come out, ready to throw himself furiously with his spines on any imprudent intruders.

Dwellings Woven with Greater Art.—Without doubt the class of birds furnishes the most expert artisans in the industry of the woven dwelling. In our own country we may see them seeking every day to right and left, carrying a morsel of straw, a pinch of moss, a hair from a horse's tail, or a tuft of wool caught in a bush. They intermingle these materials, making the framework of the construction with the coarser pieces, keeping those that are warmer and more delicate for the interior. These nests, attached to a fork in a branch or in a shrub, hidden in the depth of a thicket, are little masterpieces of skill and patience. To describe every form and every method would fill a volume. But I can not pass in silence those which reveal a science sure of itself, and which are not very inferior to what man can do in this line. The Lithuanian titmouse (*Ægithalus pendulinus*), whose works have been well described by Baldamus, lives in the marshes in the midst of reeds and willows in Poland, Galicia, and Hungary. Its nest, which resembles none met in our own country, is always suspended above the water, two or three metres above the surface, fixed to a willow branch.* All individuals do not exhibit the same skill in fabricating their dwelling; some are more careful and clever than others who are less experienced. Some, also, are obliged by circumstances to hasten their work. It frequently happens that magpies spoil, or even altogether destroy with blows

* Baldamus, Beiträge zur Oologie und Nidologie, 1853, pp. 419–445.

of their beaks, one of these pretty nests. The unfortunate couple are obliged to recommence their task, and if this accident happens two or three times to the same household, it can easily be imagined that, discouraged and depressed by the advancing season, they hasten to build a shelter anyhow, only doing what is indispensable, and neglecting perfection.

THE ART OF SEWING AMONG BIRDS.—There are birds which have succeeded in solving a remarkable difficulty. Sewing seems

FIG. 5.—THE TAILOR BIRD AND ITS NEST.

so ingenious an art that it must be reserved for the human species alone. Yet the tailor bird, the *Orthotomus longicauda*, and other species possess the elements of it. They place their nests in a large leaf which they prepare to this end. With their beaks they pierce two rows of holes along the two edges of the leaf; they then pass a stout thread from one side to the other alternately. With this leaf, at first flat, they form a horn in which they weave

their nest with cotton or hair. (Fig. 5.) These labors of weaving and sewing are preceded by the spinning of the thread. The bird makes it itself by twisting in its beak spiders' webs, bits of cotton, and little ends of wool. Sykes found that the threads used for sewing were knotted at the ends. It is impossible not to admire

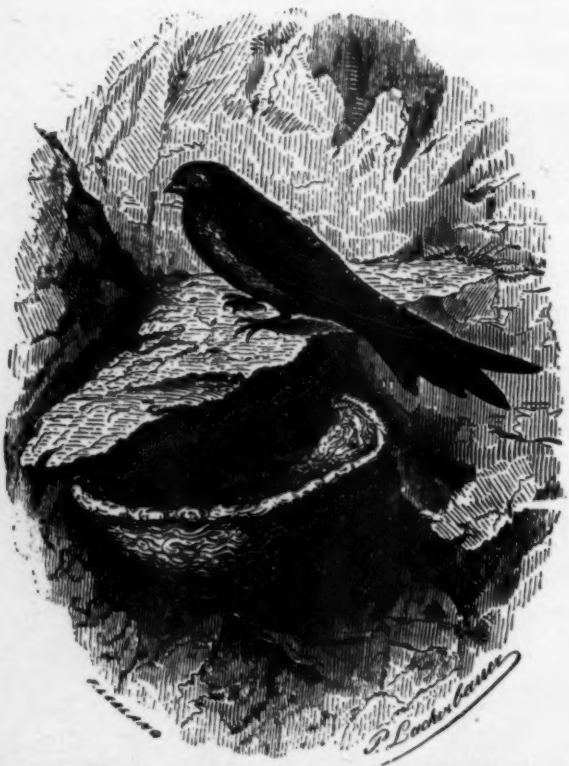

FIG. 6.—AN EDIBLE BIRDS' NEST AND THE SWALLOW THAT MAKES IT.

animals who have skillfully triumphed over all the obstacles met with in the course of these complicated operations.

GELATIN NESTS.—These are made by certain swallows who nest in grottoes or cliffs on the edge of the sea. After having collected from the water a gelatinous substance formed either of the spawn of fish or the eggs of mollusca, they carry this substance on to a perpendicular wall, and apply it to form an arc of a circle. This first deposit being dry, they increase it by sticking on to its edge a new deposit. Gradually the dwelling takes on the appearance of a cup, and receives the workers' eggs. (Fig. 6.) These dwellings are the famous swallows' nests so appreciated by the epicures of the extreme East, which are edible in the same way as, for example, caviare.

CONSTRUCTIONS BUILT OF EARTH—SOLITARY MASONS.—Cer-

tain animals, whose dwelling participates in the nature of a hollow cavern, make additions to it which claim a place among the constructions with which we are now occupied.

The *Anthophora parietina* is in this group: it is a small bee which lives in liberty in our climate. As its name indicates, it prefers to frequent the walls of old buildings, and finds a refuge in the interstices, hollowing out the mortar half disintegrated by time. The entrance to the dwelling is protected by a tube curved toward the bottom, and making an external prominence. (Fig. 7.) The owner comes and goes by this passage, and as it is curved towards the earth the interior is protected against a flow of rain, while at the same time the entry is rendered more difficult for *Melectes* and *Anthrax*. These insects, in fact, watch the departure of the *Anthophora* to endeavor to penetrate into their nests and lay their eggs there. The gallery of entry and exit has been built with grains of sand, the *débris* produced by the insect in working. These grains of sand glued together form, on drying, a very resistant wall.*

The other animals of which I have to speak are genuine masons, who prepare their mortar by tempering moistened earth.

FIG. 7.—HOMES OF MASON BEES.

Every one has seen the swallow in spring working at its nest in the corner of a window. It usually establishes its dwelling in an angle, so that the three existing walls can be utilized, and to have an inclosed space there is need only to add the face. It usually gives to this the form of a quarter of a sphere, and begins it by

* Latreille, "Observations sur l'abeille parietine (*Anthophora parietina*)," Annales du Muséum d'Hist. Nat., t. iii, 1804, p. 257.

applying earth more or less mixed with chopped hay against the walls which are to support the edifice. At the summit of the construction a hole is left for entry and exit. During the whole of its sojourn in our country the swallow uses this dwelling, and even returns to it for many years in succession, as long as its work will support the attacks of time. The faithful return of these birds to their old nest has been many times proved by attaching ribbons to their claws; they have always returned with the distinctive mark.

MASONS WORKING IN ASSOCIATION.—Ants have already furnished us with numerous proofs of their intelligence and their prodigious industry. So remote from man from the anatomical point of view, they are of all animals those whose psychic faculties bring them nearest to him. Sociable like him, they have undergone an evolution parallel to his which has placed them at the head of insects in the same way as he has become superior to all other mammals. The brain in ants, as in man, has undergone a disproportionate development. Like man, they possess a language which enables them to combine their efforts, and there is no human industry in which these insects have not arrived at a high degree of perfection. If in certain parts of the earth human societies are superior to those of ants, in many others the civilization of ants is notably superior. No village of Kaffirs can be compared to a palace of the Termites. The classifications separate these insects (sometimes called "white ants") from the ants, since the latter are Hymenoptera, while the former are ranked among the Neuroptera, but their constructions are almost alike, and may be described together. These small animals, relatively to their size, build on a colossal scale compared to man; even our most exceptional monuments can not be placed beside their ordinary buildings. (Fig. 8.) The domes of triturated and plastered clay which cover their nests may rise to a height of five metres; that is to say, to dimensions equal to one thousand times the length of the worker. The Eiffel Tower, the most elevated monument of which human industry can boast, is only one hundred and eighty-seven times the average height of the worker. It is three hundred metres high, but to equal the Termites' audacity it would have to attain a height of sixteen hundred metres.

The lofty nest, or Termitarium, constitutes a hillock in the form of a cupola. The interior arrangement is very complicated, and at the same time very well adapted to the life of the inhabitants. There are four stories in all, covered by the general exterior walls. The walls of the dome are very thick; at the base they measure from sixty to eighty centimetres. The clay, in drying, attains the hardness of brick, and the whole is very coherent. The sentinels of herds of wild cattle choose these tumuli as ob-

servatories, and do not break them down. The walls of this exterior *enceinte* are hollowed by galleries of two kinds: some horizontal and giving access from outside to all the stories, the others mounting spirally in the thickness of the wall to the summit of the dome. When the colony is in full activity, after the construction is completed, these little passages have no further use. They served for the passage of the masons when building

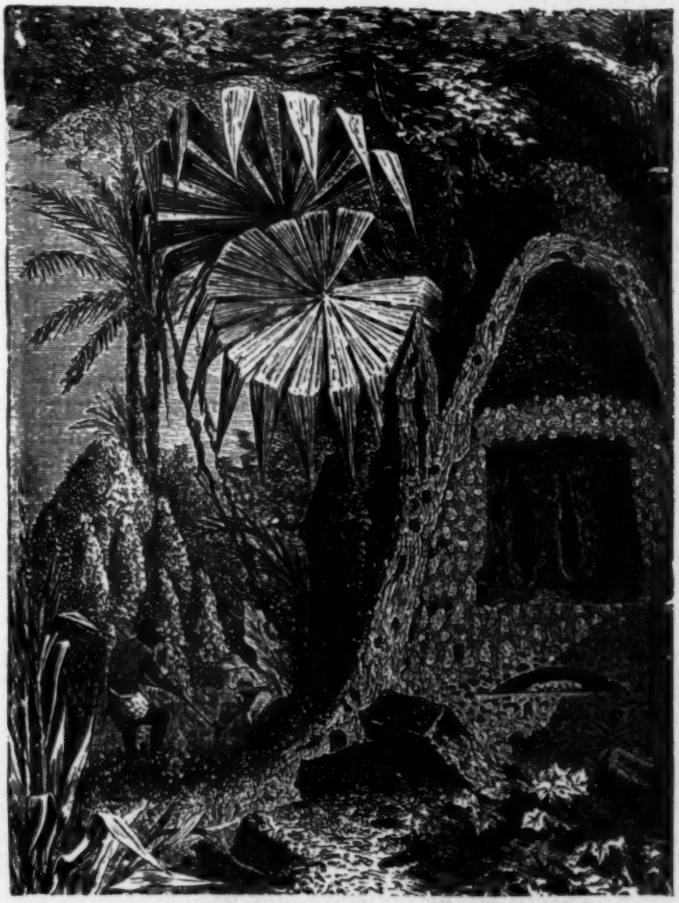

FIG. 8.—SECTION OF A PALACE OF THE TERMITES.

the cupola, and they could be utilized again if a breach should be made in the wall. At the lower part these galleries in the wall are very wide, and they sink into the earth beneath the palace to a depth of more than 1·50 metre.

These subterranean passages are the catacombs of the Termites, and have a very close analogy with those of old and populous human cities. Their origin is similar; they are ancient quarries. The insects hollowed them in obtaining the necessary

clay for their labors. Later, when the rains come, they serve as drains to carry off the water which might threaten to invade the dwelling.

Comparative anatomy has long since removed the barriers, once thought impassable, raised by human pride between man and the other animals. Our bodies do not differ from theirs; and, moreover, such glimpses as we are able to obtain allow us to conclude that their psychic faculties are of the same nature as our own. Man in his evolution introduces no new factor.

The industries in which the talents of animals are exercised demonstrate that, under the influence of the same environment, animals have reacted in the same manner as man, and have formed the same combinations to protect themselves from cold or heat, to defend themselves against the attacks of enemies, and to insure sufficient provision of food during those hard seasons of the year when the earth does not yield in abundance.

It must only be added, to avoid falling into exaggeration, that man excels in all the arts, of which only scattered rudiments are found among the other animals; and we may safeguard our pride by affirming that we need not fear comparison. If our intelligence is not essentially different from that of animals, we have the satisfaction of knowing that it is much superior to theirs.

THE ORIGIN OF RIGHT-HANDEDNESS.

By J. MARK BALDWIN,
PROFESSOR OF EXPERIMENTAL PSYCHOLOGY IN PRINCETON UNIVERSITY.

THE question "Why are we right or left handed?" has exercised the speculative ingenuity of many men. It has come to the front anew in recent years in view of the advances made in the general physiology of the nervous system; and certainly we are now in a better position to set the problem intelligently and to hope for its solution. Hitherto the actual conditions of the rise of "dextrality"—as the general fact of uneven-handedness may be called—in young children have not been closely observed. It was to gain light, therefore, upon the facts themselves that the experiments described in the following pages were carried out.

My child H—— was placed in a comfortable sitting posture, the arms left bare and free in their movement, and allowed to reach for objects placed before her in positions exactly determined and recorded by a simple arrangement of sliding rods. The experiments took place at the same hour daily for a period extending from her fourth to her tenth month. These experiments were

planned with very great care and with especial view to the testing of several hypotheses which, although superficial to those who have studied physiology, yet constantly recur in publications on this subject.* Among these theories certain may be mentioned which my experimental arrangements were aimed to test. It has frequently been held that a child's right-handedness arises from the nurse's or mother's constant method of carrying it; the child's hand which is left free being more exercised, and so becoming stronger. This theory is ambiguous as regards both mother and child. The mother, if right-handed, would carry the child on the left arm, in order to work with the right arm. This I find an invariable tendency with myself and with nurses and mothers whom I have observed. But this would leave the child's left arm free, and a right-handed mother would be found with a left-handed child. Again, if the mother or nurse is left-handed, the child would tend to be right-handed. Or if, as is the case in civilized countries, nurses replace the mothers, it would be necessary that most of the nurses be left-handed in order to make most of the children right-handed. Neither of these positions is true. Further, the child, as a matter of fact, holds on with both hands, however it is itself held. Another theory maintains that the development of right-handedness is due to differences in weight of the two lateral halves of the body; this tends to bring more strain on one side than the other, and so to give more exercise to that side. This evidently assumes that children are not right or left handed before they learn to stand. This my results given below show to be false. Again, we are told that infants get right-handed by being placed on one side too much for sleep: this can be shown to have little force also, when the precaution is taken to place the child alternately on its right and left sides for its sleeping periods.

In the case of the child H—— certain precautions were carefully enforced. She was never carried about in arms at all—never walked with when crying or sleepless (a ruinous and needless habit to cultivate in an infant); she was frequently turned over in her sleep; she was not allowed to balance herself on her feet until a later period than that covered by the experiments. Thus the conditions of the rise of the new right-handed era were made as simple and uniform as possible.

The experiments included, besides reaching for colors, a great many of reaching for other objects, at longer and shorter distances, and in unsymmetrical directions. The following table (I)

* Cf. Vierordt's remarks, Physiologie des Kindesalters, pp. 428, 429. For a detailed statement of theories on this topic, see chapter x of the very learned monograph on The Right Hand: Left-handedness, by my late lamented colleague and friend Sir Daniel Wilson.

gives some details of the results of the experiments in which simple objects were used, extending over a period of four months (fifth to ninth in her life). The number of experiments at each sitting varied from ten to forty; the position of the child being reversed after half of each series.

TABLE I.

DATE.	No. of series.	No. of experiments.	Right hand.	Left hand.	Both hands.
1890. February 10th to March 15th...	30	744	173	166	405
March 14th to April 14th.....	25	623	134	141	348
April 14th to May 14th.....	25	546	213	130	203
May 14th to June 19th.....	16	274	57	131	86
Total.....	96	2,187	577	568	1,042

It is evident from Table I that no trace of preference for either hand is discernible during this period; indeed, the neutrality is as complete as if it had been arranged beforehand, or had followed the throwing of dice.

I then conceived the idea that possibly a severer distance test might affect the result and show a marked preferential response by one hand over the other. I accordingly continued to use a neutral stimulus, but placed it from twelve to fifteen inches away from the child. This resulted in very hard straining on her part, with all the signs of physical effort (explosive breathing, sounds resulting from the setting of the larynx, rush of blood to the head, seen in flushing of the face, etc.). Table II gives the results; the number in each series was very small—i. e., one to twelve (in one instance only):

TABLE II.

DATE.	No. of series.	No. of trials.	Right hand.	Left hand.	Both hands.
1890. May 26th to June 10th.....	32	80	74	5	1

The same cases, distributed according to distance, give us Table III.

TABLE III.

	12 inches.	13 inches.	14 inches.	15 inches.
Right hand.....	29	10	33	2
Left hand.....	5	..	..	..
Both hands.....	1	..	..	..

A comparison of II and III with I shows a remarkable difference—i. e., during the month ending June 15th, the child showed

no preference for either hand in reaching straight before her within easy reaching distance (ten inches); but she was right-handed to a marked degree during the same period as regards movements which required effort or strain, such as grasping for objects twelve to fifteen inches distant. The left hand was used in only five cases as against seventy-four cases of the use of the right hand; and further, all these five cases were twelve-inch distances, the left hand being used absolutely not at all in the forty-five cases at longer distances.

In order to test this point further, I varied the point of exposure of the stimulus to the right or left, aiming thus to attract the hand on one side or the other, and thus to determine whether the growth of such a preference was limited to experiences of convenience in reaching to adjacent local objects, etc. The result appears in Table IV:

TABLE IV.

	12 inches.	13 inches.	14 inches.	15 inches.	Hand used.	
					Right.	Left.
Deviations from median line—						
2 to 6 inches to left.....	10 cases	15 cases	4 cases	....	35	....
2 to 6 inches to right....	2 "	3 "	1 "	....		
Same conditions with color stimulus.....	....	....	....	....	15	2

This table shows that deviation to the left in front of the body only called out the right hand to greater exertion, while the left hand fell into still greater disuse. This seems to show that dextrality is not derived from the experience of the individual in using either hand predominantly for reaching within the readiest range of that hand.

Proceeding upon the clew thus obtained—i. e., that a stronger effort brought a preferential hand reaction—a clew which seems to suggest that the hand preference is a function of the relative strength of the influence of the eye stimulus, I introduced hand observations into a series of experiments on the same child's perception of the different colors which I was making at that time, thinking that the color stimulus which represented the strongest inducement to the child to reach, might have the same effect in determining the use of the right hand as the increased distance in the experiments already described. This inference is proved to be correct by the results given in Table V:

TABLE V.

Color stimulus, 10 to 15 inches	Hand.....	Right.	Left.	Both.	May 23d to June 19th.
	Number of cases.....	86	2	..	

It should be added that in all cases in which both hands are said to have been used, each hand was called out with evident in-

dependence of the other, both about the same time, and both carried energetically to the goal. In many other cases in which either right or left hand is given in the tables, the other hand also moves, but in a subordinate and aimless way. There was a very marked difference between the use of both hands in some cases, and of one hand followed by, or accompanied by, the other in other cases. It was very rare that the second hand did not thus follow or accompany the first; and this was extremely marked in the violent reaching for which the right hand was mainly used. This hand was almost invariably accompanied by an objectless and fruitless symmetrical movement of the other.

The results of the entire series of experiments on the use of the hands may be stated as follows, mainly in the words in which I reported them summarily some time ago: *

1. I found no trace of preference for either hand as long as there were no violent muscular exertions made (based on 2,187 systematic experiments in cases of free movement of hands near the body: i. e., right hand, 577 cases; left hand, 568 cases; a difference of nine cases; both hands, 1,042 cases; the difference of nine cases being too slight to have meaning).

2. Under the same conditions the tendency to use both hands together was about double the tendency to use either (seen from the number of cases of the use of both hands in the statistics given above), the period covered being from the child's sixth to her tenth month inclusive.

3. A distinct preference for the right hand in violent efforts in reaching became noticeable in the seventh and eighth months. Experiments during the eighth month on this cue gave, in 80 cases, right hand, 74 cases; left hand, 5 cases; both hands, 1 case. This was true in two very distinct classes of cases: first, reaching for neutral objects (newspaper, etc.) at more than the reaching distance; and, second, reaching for bright colors at any distance. Under the stimulus of bright colors, from 86 cases, 84 were right-hand cases and 2 left-hand. Right-handedness had accordingly developed under pressure of muscular effort in the sixth and seventh months.

4. Up to this time the child had not learned to stand or to creep; hence the development of one hand more than the other is not due to differences in weight between the two longitudinal

* Science, xvi, October 31, 1890; discussed by James, Science, November 8, 1890, by Dr. J. T. O'Connor, ibid., xvi, 1890, p. 331, and by myself, ibid., xvi, November 28, 1890. The report is quoted in full in Nature, November 13, 1890, and in part in the Illustrated London News, January 17, 1891. See also Ebbinhaus's Zeitsch. für Psychologie, ii, 1891, p. 239; Wilson, The Right Hand: Left-handedness, pp. 128–131; Revue Scientifique, 1891, ii, p. 493; discussed by Mazel, Revue Scientifique, 1892, i, p. 113. Both writers in the last-named journal cite these experiments wrongly as Wilson's.

halves of the body. As she had not learned to speak or to utter articulate sounds with much distinctness, we may say also that right or left handedness may develop while the motor speech center is not yet functioning.

5. In most cases involving the marked use of one hand in preference to the other, the second or backward hand followed slowly upon the lead of the first, in a way clearly showing symmetrical innovation of accompanying movements by the second hand. This confirms the inference as to such movements drawn from the phenomena of mirror-writing, etc., by Fechner and E. H. Weber.

Some interesting points arise in connection with the interpretation of these facts. If it be true that the order of rise of mental and physiological functions is constant, then for this question the results obtained in the case of one child, if accurate, would hold for others apart from any absolute time determination. We would expect, therefore, that these results would be confirmed by experiments on other children, and this is the only way their correctness can be tested.*

If, when tested, they should be found correct, they would be sufficient answer to several of the theories of right-handedness heretofore urged. The phenomenon can not be due to differences in balance of the two sides of the body, for it arises before the body begins to stand erect. It can not be due to experience in the use of either hand, since it arises when there is no such difference of experience, and since the hand preferred is used, as a matter of fact, for purposes for which in experience the other would be altogether more convenient.† The rise of the phenomenon must be sought, therefore, in more deep-going facts of physiology than such theories supply.

If, on the other hand, heredity be brought to the aid of these "experience" theories, it is possible to claim that, as structure is due to function, experience of function must have been first; and only thus could the modification in structure which is now sufficient to produce right-handedness in individual cases have been brought about. On the other hand, if we go lower in the animal scale than man, analogies for the kinds of experience which are

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* Vierordt says concerning such experiments: "Adequate observations are wanting on the grasping movements of the infant's left and right arm—a kind of observations which would be of the first importance for this inquiry" (Physiologie des Kindesalters, p. 428); and Wilson: "Only a prolonged series of observations, such as those by Prof. Baldwin already noted, made at the first stage of life, and based on the voluntary and the unprompted actions of the child, can supply the needful data" (Left-handedness, p. 209).

† An additional point, which I think is true, is that a right-handed child learns to shake hands properly—using the more inconvenient hand across his body—more easily than the left-handed child.

urged as reasons for right-handedness are not present; animals do not carry their young, nor pat them to sleep, nor do animals shake hands! It must therefore be shown that animals are right or left handed, or that they differ in some marked respect in regard to function, in their nervous make-up, from man. Admitting the need of meeting these requirements; admitting again that we have little evidence that animals are dextral in their functions; admitting also the known results as to the control of the two halves of the muscular system by the opposite brain hemispheres respectively; admitting further that the motor speech function is performed by the hemisphere which controls the stronger side of the body, and is adjacent to the motor arm center in that hemisphere; and admitting, finally, that the speech function is one in which the animals have little share—all these admissions lead us at once to the view that there is a fundamental connection between the rise of speech and the rise of right-handedness.*

Looking broadly at the methods of nervous and muscular development, and accepting all the results of neurology we are able to gather, we may say that in the differentiation of functions in the animal series certain principles may be recognized: 1. The deep-seated vital functions represent least nervous differentiation, as is seen in the simple organs known as the lower nervous centers. 2. New unsymmetrical functions give a differential or twofold organic development, the great instance of which is found in the cerebral hemispheres. 3. New symmetrical or unilateral functions find their counterpart each in one of three kinds of nervous adaptation: (*a*) co-ordination of the hemispheres in a single function—i. e., functions which are crippled if either hemisphere is damaged; (*b*) co-ordination of particular functions in each hemisphere—i. e., functions which are not crippled unless both hemispheres are damaged; and (*c*) co-ordination of particular functions in one hemisphere only—i. e., functions which are crippled if one selected hemisphere is damaged. All these kinds of co-ordination exist.

It is easy to see that both speech and right-handed function belong under the last head of the last class—co-ordinations of particular functions in one hemisphere only—and that they belong in the same hemisphere. Why is this? What have they in common?

A very essential kind of hand movements are the so-called "expressive" movements, meaning those which serve to convey a meaning, or express a state of consciousness. Of course, speech is

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* This much has been before surmised (see Mazel, Revue Scientifique, 1892, i, p. 113). He makes no attempt, however, to account for the association, except by calling both functions expressive.

par excellence the function of expression. It is further only a part of the position upon which the psychological theory of expression is based, that all movements are in so far expressive, and that details of expression and its relative fullness are matters of co-ordination. Now, this co-ordination has attained its ripest and most complex form, apart from speech, in movements of the hand. Upon this view it is easy to hold that right-handedness is a form of expressive differentiation of movement, and that it preceded speech, which is a further and more complex form of differentiation and adaptation.

The neurological basis upon which this hypothesis rests is adequate, and affords a presumption as to the psychological development as well. The facts I have now given, for the first time, go some way to support the view: 1. Right-handedness arose before speech in the child H——. 2. Imitation by the hand of movements seen arise before articulate imitations of sounds heard;* this in spite of the fact that hearing, in its development in the child, becomes perfect before sight. 3. Characteristic differences in children in respect to their general mobility of arm and hand, manual skill, and quickness of manipulation, extend also to speech. As compared with my other child, E——, the first-born, H——, is remarkably agile and motile generally in her temperament; and her speech development was relatively much earlier and more rapid.

It is further interesting to note that musical ability is associated with speech ability—a connection which would be expected when one takes due account of the expressive character and function of music. As far as theories of the rise of musical expression have gone, they unite in finding its beginnings in the rudimentary emotional expressions of the animals. The singing of birds is undoubtedly connected with their mating instincts. Pathological cases also show a marked connection between musical execution and speech, to the extent that, while musical defect almost invariably involves speech defects, the reverse is much less generally true—a fact which confirms the view that music is an earlier form, but still a form, of expressive reaction.

Late observations also show, as far as they are sufficient, that the center for music expression is also located normally in the left hemisphere for right-handed persons. Oppenheim reports a case † of total aphasia with total amusia (lack of musical ability from disease) in which the recovery of speech brought with it musical recovery also. Furthermore, another case of Oppenheim's shows motor aphasia with motor amusia only—i. e., the

* It is interesting that of both hand and speech movements the latest to be lost in disease are those involved in the so-called "mimicry" of movement and in imitative speech.

† Charité Annalen, xiii, 1888, p. 286.

patient could still understand tunes, and, further, could imagine tunes "in his head" (what the French call *intérieur*), while he could not sing them. This shows a close connection in locality between motor speech and motor music function, while a slight separateness of the two centers in locality in the left hemisphere, explains cases of motor aphasia in which musical execution is preserved. Further, Frankl-Hochwart declares that no cases are recorded of amusia from lesion in the right hemisphere,* and Starr says (in a private letter) of a patient of his:† "My patient is right-handed, and music does follow speech in being unilaterally located; . . . it is well proved that the musical faculty is one-sided in location." Despite these positive opinions, I think more critical cases with autopsy are necessary to make the position quite secure.

All this means simply that the general cause to which is due the fact of right-handedness is also the cause, through further differentiation and emphasis in the same local seat, of the development of musical ability and of speech. It now remains to ask: What was or is this cause, and when in the race-history series did it begin to operate? There are only two hypotheses of any force —either "experience" or "spontaneous variation" at some stage in biological development.

It is extremely improbable that dextrality should have arisen among the quadrupeds (or amanous bipeds), for experience was lacking of unilateral stimulation, and a spontaneous variation of this kind would have produced such inconvenience of locomotion and ultimately such asymmetry of form that it would have been weeded out.‡ As an extreme example, fancy a bird which is dextral in its flight.*

As soon as we come to bipeds with hands, however, these reasons do not hold. Their locomotion does not depend on manual symmetry, and any dextrality, however slight, would be of direct advantage in climbing, fighting, breaking sticks, and pulling fruit; since a disproportionate growth of one side would give that side greater strength than either side would possess in animals of symmetrical development in the same environment. A very strong one-armed man can keep at bay a weaker man with two arms, or destroy him, and this is emphasized in animals, where brute force is the only resource. It is difficult to find, however, in the habits of simians any ground for believing that there has

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* This means that all cases noted have been right-handed. Deutsche Zeitsch. für Nervenheilkunde, 1891, i, p. 295 and foot-note.

† Referred to in The Psychological Review, January, 1894, p. 92.

‡ For this reason the human leg, as Brown-Séquard says, is not as right-sided as the arm.

* The only evidence I know of such a thing is that a cat swims in a circle; but then dogs and horses do not.

been a form of unilateral stimulation which would act to effect a structural change in one hemisphere over and above the other. But, apart from this, there is every reason to expect, quite independently of function, that two organs of such comparative separateness and independence of function would not remain exactly balanced in function; in short, spontaneous variations giving advantageous dextrality would inevitably arise and persist as soon as the habits of life were not such that more important functions, such as locomotion, tended to suppress them and restore bilateral equilibrium.* There are, as far as I know, very few published observations of fact in regard to simian or animal dextrality.†

It is likely, therefore, that right-handedness in the child is due to differences in the two half-brains, reached at an early stage in life, that the promise of it is inherited, and that the influences of infancy have little effect upon it. Yet, of course, regular habits of disuse or of the cultivation of the other hand may, as the child grows up, diminish or destroy the disparity between the two. And this inherited brain-onesidedness also accounts for the association of right-handedness and speech—the speech function being a further development of the same unilateral potency for movement found first in right or left handedness.

THE Marquis of Salisbury has been nominated as president of the next meeting of the British Association, which will be held in Oxford, August 8th. In proposing him, Sir F. Bramwell mentioned, as among the claims of the marquis, that he had been Chancellor of the University of Oxford since 1880, that he would therefore represent both hosts and guests, that he was a distinguished statesman, a courteous gentleman, a member of the Council of the Royal Society, and a true man of science. Ipswich has been designated as the place for the meeting of 1895.

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* It is on this point that I differ from Wilson, who claims that while some are naturally right or left handed, most people owe the peculiarity to education; the evidence, apart from my experiments, is well put by Mazel, *loc. cit.*

† I know only the assertion of Vierordt that parrots grasp and hold food with the left claw, that lions strike with the left paw, and his quotation from Livingstone—i. e., "All animals are left-handed" (Vierordt, *loc. cit.*, p. 428). Dr. W. Ogle reports observations on parrots and monkeys in Trans. Royal Med. and Chirur. Society, 1871. Dr. Ogle informs me in a private letter that the chimpanzee which recently died in the Zoölogical Garden in London was discovered by him to be left-handed. I have addressed a circular letter to some of the officials in zoölogical institutions here and abroad, and hope to gather some facts in this way. It is evident that on this theory of spontaneous variation any change which produced a permanent organic superiority of one hemisphere would be sufficient, and the view that the difference in the hemispheres is due to a better blood supply to the left hemisphere might thus have its justification. As a matter of fact, the arterial arrangements do seem to indicate a more direct blood supply to the left hemisphere (cf. the note of Dr. J. T. O'Connor, apropos of my experiments, in Science, xvi, 1890, p. 331). It is an interesting inquiry whether this arterial arrangement is reversed in left-handed persons. Wilson cites two cases in which there was no such correspondence (*loc. cit.*, p. 179).

FOSSIL MAN.*

By JOHN G. ROTHERMEL.

WITHIN a comparatively short time our knowledge of man's existence upon the earth has been greatly increased. By the aid of monuments, language, man's handicraft in stone, brass, bronze, and iron in constructing implements of warfare and husbandry, the anthropologist has been able to classify prehistoric man into ages—namely, the chipped stone or palæolithic, the polished stone or neolithic, the brass, the bronze, and the iron ages.

The purpose of this paper is to deal with the evidence of the earliest of these. The records are to be found in Nature's infallible history of the world's development printed on pages of rock in fossil type. In order that those present not conversant with geology may more clearly understand what is to follow, it will perhaps be well to briefly explain the order and arrangement of these pages of rock.

To carry out the simile, we might say that this great history is written in three volumes—the first and earliest called Palæozoic or Primary; the second, Mesozoic or Secondary; and the third, Kainozoic or Tertiary. The first volume, or Palæozoic, is divided into three books, each book treating of the flora and fauna which existed at the time of which it speaks. The first book is called Silurian, and treats of that part of the age when invertebrates predominated; the second, Devonian, and treats of that part of the age when fishes predominated; the third, Carboniferous, and treats of that part of the age when coal plants predominated. The second volume, or Mesozoic, is a record of the times when reptiles predominated. The third volume, Kainozoic, is a record of the times when mammals predominated.

It must be understood that there is no clear-cut line of demarcation separating the life of these ages, some of the forms of the earliest existing to-day, others having become extinct, the orders of life named with each age being simply the predominating life of the period. All these periods are divided into many minor subdivisions. Man being a mammal, we are, however, interested only in the subdivisions of the Kainozoic or Tertiary. This period, beginning with the earliest, is divided into Eocene, Oligocene, Miocene, Pliocene, and Post-Pliocene or Post-Tertiary, also called Quaternary. For the purposes of this subject we are interested mainly in the Post-Pliocene or Quaternary, which some

* A lecture delivered May 12, 1893, in the Popular Course before the Academy of Natural Sciences, Philadelphia.

geologists subdivide, beginning with the earliest, into Pleistocene, Glacial, and Recent.

The most important features of the Post-Pliocene or Quaternary period are: First, the advent of man and contemporaneous flora and fauna. Second, the great Glacial period—the period when the glaciers extended over the greater part of Europe and North America, as attested by the drift formation with its immense bowlders torn from mountain sides and carried a hundred miles or more; glacial scratches — grooves made by the rocks carried by the glaciers on the surfaces upon which they moved; terminal and lateral moraines, heaps of rocks left by the melting ice marking the limits of the glaciers. This Glacial epoch separates the Post-Pliocene into the three divisions mentioned before, which may be called Preglacial, Glacial, and Post-glacial, instead of Pleistocene, Glacial, and Recent.

FIG. 1.—THE SKULL FROM THE NEANDERTHAL CAVERN. A, side; B, front; and C, top view. The outlines from camera lucida drawings, one half the natural size, by Mr. Busk; the details from the cast and from Dr. Fuhlrott's photographs. *a*, glabella; *b*, occipital protuberance; *d*, lambdoidal suture. (From Huxley's Man's Place in Nature.)

It will, perhaps, be of interest to briefly indicate some of the hypotheses that have been advanced to account for this Glacial epoch. In the first place, any hypothesis, in order to satisfy the necessities of the proposition, must include two seemingly opposed conditions and explain their interaction. To form a glacier, both heat and cold are necessary; to form an ice mass, there must be something to be frozen; therefore there must exist sufficient heat to vaporize water, charging the atmosphere with aqueous vapor, which when carried to higher altitudes or subjected to cold is condensed and precipitated in the form of snow, the accumulation of which forms the glaciers. Hence, in a glacial region, if the mean temperature is comparatively high, the snowfall must be great, otherwise the heat would melt the snow faster

than or as fast as it accumulated; if the mean temperature is low, the snowfall may be light and yet the glaciers accumulate, as the heat would be insufficient to melt that which did fall; but if the mean temperature is so high as to prevent the accumulation of snow, or so low as to prevent the formation of aqueous vapor, there can be no glaciers formed, the last conclusion being subject to the qualification that a vapor-laden atmosphere may be carried by prevailing winds from a warm climate to a cold one, and the vapor there condensed and precipitated.

One hypothesis is that the whole solar system passes at times through stretches of space of different temperatures, and that the Glacial period coincides with a time when the solar system was passing through a low-temperature area; another is that the heat of the sun varies, such variations being the result mainly of contact with meteorites, as the impact of bodies generates heat, the idea being that the Glacial epoch coincides with a time when

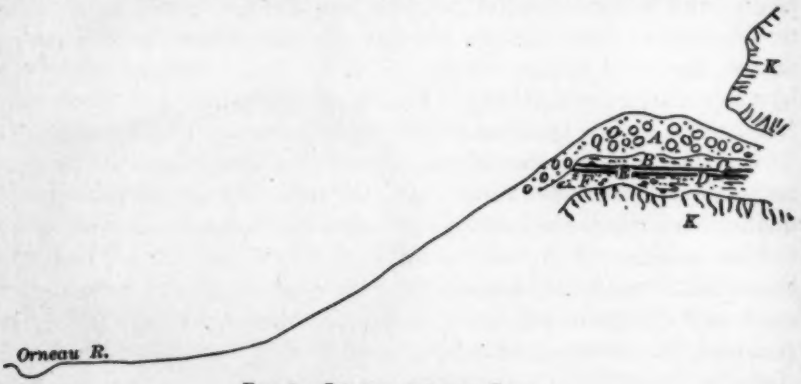


FIG. 2.—SECTION THROUGH CAVE.

few meteorites were colliding with the sun, the heat emanating therefrom being therefore decreased. These two hypotheses agree in one particular—they can neither be proved nor disproved, consequently their only value is speculative.

Again, it is supposed that the earth's axis has shifted—that during the Glacial period the north pole was in Greenland. This seems to be negatived by the slight observed shifting of the pole, and the fact that Tertiary fossil flora, immediately preceding the Glacial period, of both Greenland and the present arctic regions, indicate a temperate climate.

Adhémar the astronomer advanced the hypothesis, also advocated by the late Dr. James Croll and Prof. James Geikie, that, as the earth's orbit is elliptical and as the sun is not central to this orbit but some three million miles nearer one end than the other, this fact in connection with the precession of the equinoxes may explain the Glacial epoch; it being held that during that

period when winter in the Northern hemisphere coincides with the earth's position in its orbit farthest from the sun, the mean temperature of the Northern hemisphere will be considerably lower than when the reverse conditions prevail—that is, when winter in the north coincides with the earth's position in its orbit nearest to the sun, as at present. Moreover, this change of position of the earth in its orbit would likely result in a change in direction of the trade winds, the air currents being mainly caused by the expansive action of heat creating a vacuum into which the air rushes from colder areas; therefore, as the Southern hemisphere would become the warmer, the prevailing winds would be southward, thus changing the direction of ocean currents, like the Gulf Stream, to the southward, this being a secondary cause resulting from the first and further intensifying the cold.

This hypothesis is supported by the fact that at present winter in the Southern hemisphere coincides with the earth's position in its orbit farthest from the sun, and the ice around the south pole extends much farther toward the equator than that around the north pole, the antarctic ice extending as far as the sixty-seventh degree of latitude. The antarctic summers are also said to be more humid, cold, and chilly than the arctic summers.

But the earth's orbit is not always the same; there have been periods when the orbit described resulted in a considerably greater difference than three million miles, and it is thought that if this ordinary eccentricity of the orbit is insufficient to account for the Glacial epoch, the periods of greater eccentricity would.

This hypothesis seems to explain rather overmuch, for if true, it accounts not only for the Glacial period, but for many glacial periods in the past, for, other conditions remaining the same, there would result a Glacial period for every period in the past that the earth held the proper relative position in its orbit; and if true, there should be geological evidence to sustain it, which there does not appear to be, for such evidence of earlier glaciers as the rocks of past geological ages exhibit would seem to indicate local glaciers, not any widespread glacial action; but it would be rash to maintain that the other conditions remained the same; geology can not be said to show that they did.

Still another hypothesis is that the Isthmus of Panama was in glacial times submerged, thus allowing the Gulf Stream to flow into the Pacific Ocean and thence north; also that the northern coast of British America was more elevated than at present. There is geological evidence to sustain both these propositions, but not conclusively. It is obvious that under these conditions the eastern part of the northern coast would be much colder, being more elevated and having lost the heat emanating from the Gulf Stream, while the western part would be warmer, having

gained the heat of the Gulf Stream; thus for the eastern part we have cold accounted for and for the western part heat—but the glacial condition extended the whole length; therefore, while it seems possible that glaciers might form on the western part by reason of the snowfall being great, the case is different for the eastern part, which seems to have been entirely deprived of its vapor-making element, heat, for even under existing conditions the mean temperature of Greenland and Labrador is low and the snowfall light as compared with Alaska. The answer is made to this that western winds carried the moisture-laden atmosphere from the west coast to the east, but these winds would have to cross the Sierra Nevada and Rocky Mountains, forcing them to higher altitudes, resulting in the condensation and precipitation of their vapor upon the mountains. This difficulty is overcome by having recourse to the immense lava outflows, covering thousands of square miles west of the Rocky Mountains, which are supposed to have taken place about the Glacial period; this molten mass is supposed to have generated so much heat as to modify the customary effect of mountain ranges and get the vapor-laden atmosphere to the needed point and thus satisfy the hypothesis, but it offers no explanation of the Glacial period in Europe.

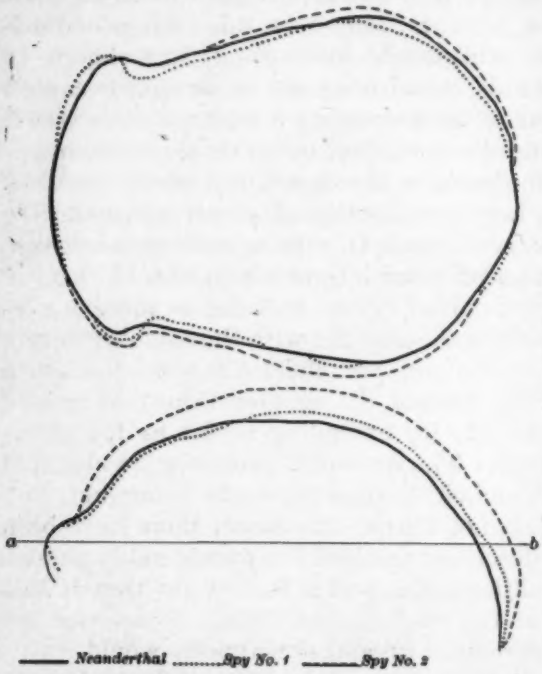


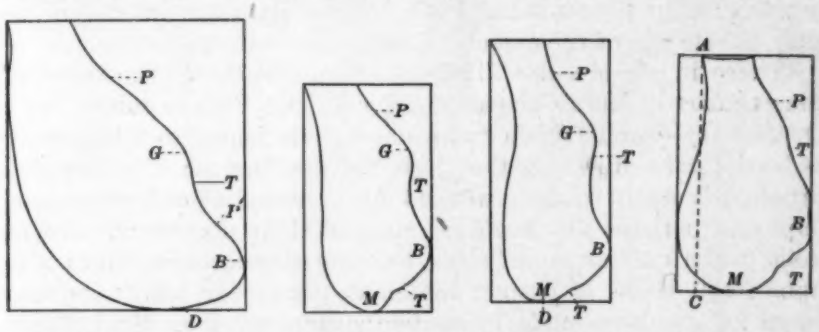
FIG. 3.—SUPERIMPOSED OUTLINE DRAWINGS OF SKULLS.

Many leading geologists favor this view, while others think the truth will be found in a combination of the last two hypotheses, both being in some measure contributory to the result.

Fossil man has been found in certain countries associated with the remains of certain animals, among which are the mammoth, woolly rhinoceros, cave bear, fossil horse, Irish elk, cave hyena, cave tiger, reindeer, elk, musk ox, aurochs, hippopotamus, lion, and others. These animals are either now extinct or are, for cli-

matal and other reasons, no longer inhabitants of the countries where fossil man has been found; hence, as related to those countries, they are all extinct.

It will be noticed that, of these animals as we now know them, the lion, tiger, hyena, and hippopotamus are tropical, or indigenous to warm climates. The reindeer and musk ox are arctic, and no doubt the extinct mammoth and woolly rhinoceros were arctic also. During glacial times these arctic and tropical animals appear to have occupied the same territory contemporaneously. This fact seems more particularly conspicuous with the lion, tiger, hyena, hippopotamus, mammoth, and woolly rhinoceros; the reindeer and musk ox appearing, at least abundantly, somewhat later. This fact has given rise to considerable difference of opinion. It has been argued that the tropical forms are



Chimpanzee. Spy Man No. 1. Spy Man No. 2. Modern Man.

FIG. 4.—OUTLINE DRAWINGS OF THE SYMPHYSES. (From Fraipont and Lohest.)

post-glacial, and that subsequent to the Glacial period the glaciated area passed through a period of tropical conditions.

This argument seems clearly untenable from any point of view, as there is no evidence of a tropical climate intervening between the Glacial epoch and the present temperate climate. All the evidence shows a gradual amelioration of climate until the present conditions are reached. Again, as the mammoth and woolly rhinoceros, supposed to be arctic forms, appear associated with the tropical forms in the same deposit, side by side, they would have to be considered tropical. For this there is reason, as their present representatives, the elephant and rhinoceros, are tropical.

But the facts are these: the reindeer and musk ox, known arctic forms, appear later than the supposed tropical forms. In all excavations through glacial material the tropical forms with mammoth and woolly rhinoceros appear in the lower levels, never superficially; where several fossil beds are gone through, the upper or superficial beds contain the reindeer more abun-

dantly; where the reindeer occurs in the lower levels associated with the mammoth, woolly rhinoceros, hyena, etc., it is not abundant.

It seems more reasonable to suppose that these tropical forms were adapted to the cold climatal conditions in some way, as the mammoth and woolly rhinoceros were, or that the conditions were not as severe as the immense accumulations of ice would lead us to imagine, for, as we have seen, if the precipitation is great, the mean temperature need not necessarily be very low.

Prof. James Geikie thinks that during the Glacial epoch there were periods of high temperature, when the glaciers retreated and tropical animals migrated into the glacial region. However this may be, it is evident from what has been said that these tropical animals, with the woolly rhinoceros and mammoth, were either interglacial or preglacial or both. These data are important, as they fix the age of the associated human remains.

There is considerable diversity of opinion as to the value of the evidence of man's existence prior to the Pleistocene or early Quaternary—such evidence as we have being open to criticism or at least to the objection that it is not conclusive; it is founded principally upon roughly worked flints and flint chippings, perhaps and perhaps not made by man, as their occurrence can, at least to the satisfaction of some, be otherwise accounted for; also upon fossil bones of extinct mammals that bear markings supposed to have been made by contemporaneous man. Such bones have been found in both Pliocene and Miocene formations, and their incisions differently interpreted by different naturalists. Quite recently Prof. Cope has found in the Pliocene of southwestern Oregon obsidian implements of human manufacture associated and interbedded with remains of fossil birds, but by what agency they got there has not been determined.

The argument has been advanced as to Miocene man that, as all the mammalia of this period are extinct, it does not appear reasonable that man alone should survive the causes that proved so fatal to the rest of the mammalia. Against this it may be urged that man's superior intelligence would enable him to overcome adverse circumstances that would prove destructive to other forms. In fact, this superior intelligence may have been a potent factor in the destruction of the other forms.

In 1863 M. Desnoyes found in the gravel pit of Saint Prest, near Chartres, a leg bone (tibia) of a rhinoceros. It bore marks resembling those undoubtedly made by man on other more recent bones. Reasoning by analogy, the marks on the Saint Prest bone are also supposed to have been made by man. In the Victoria cave, Yorkshire, there was found a human leg bone (fibula). Both of these deposits have been considered by competent au-

thority to belong to the transition period between the Pliocene and Pleistocene.

In the year 1700, at Cannstadt, Würtemberg, Germany, there was found a portion of a human skull associated with animal remains. Its value was not known until 1835, when Jaeger recognized its importance as evidence of the coexistence of man with the extinct mammals. This appears to have been the first true fossil of man found.

In 1857 a human skeleton was discovered in a limestone cave in the Neanderthal gorge near Hochdal, between Düsseldorf and Elberfeld, Prussia, associated with remains of extinct mammals.

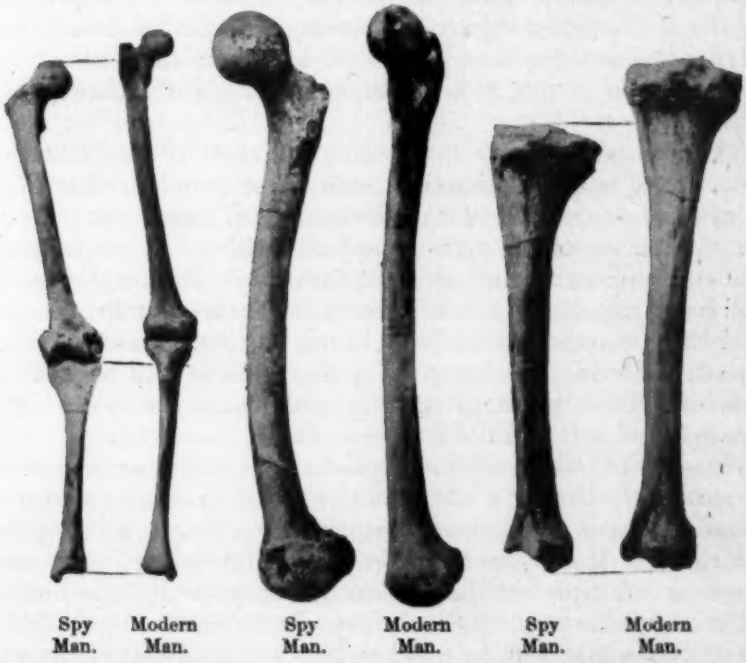


FIG. 5.—SHOWING LEG BONES. (From Fraipont and Lohest.)

Unfortunately, the value of this find was not known to the workmen who made it, and most of the skeleton was lost. Dr. Fuhlrott, however, succeeded in securing the cranium, both thigh bones, two arm bones (a right radius and a left humerus), and a hip bone (left ilium). In the same year these were described by Dr. Schaffhausen. All the facial bones were lost. The cranium consists only of that portion situated above the roof of the orbits and the superior occipital ridges. This skull has become famous, and is known as the Neanderthal skull. When first found its remarkable peculiarities gave rise to much discussion. Many naturalists considered it a special species or even genus; others con-

sidered it as intermediate between man and the apes, and at last, in order to find some place for it, it was regarded by many as the skull of an idiot.

The peculiarities that gave rise to these opinions consist mainly as follows: A long, narrow skull, a low, rapidly retreating forehead, and an exceptional development of the brow ridges (superciliary ridges); these are so prominent that there is a depression behind or between them and the frontal bone. They, moreover, coalesce in the middle line, making a deep depression at the root of the nose. The bones are also unusually thick, the whole configuration remarkable and decidedly apelike and brutal.

The other bones found are in keeping with the skull, being thick and characterized by the unusual development of ridges and depressions for attachment of muscles; they would indicate a stature of five feet six to five feet eight inches (1·68 to 1·72 metre).

The cranial capacity has been calculated to be 74·42 cubic inches (1,220 cubic centimetres), said to be equal to that of the Malays and superior to that of the Hindus of small stature. The cranial capacity of the most capacious gorilla skull yet measured is thirty-four and a half cubic inches, while the largest human skull had a capacity of one hundred and fourteen cubic inches, the mean European skull being from ninety to ninety-six cubic inches, so that, while in capacity there is a wide difference between the Neanderthal skull and the gorilla skull, there is also a wide difference between it and the European skull.

In what is known as the cephalic index this skull does not compare unfavorably with skulls of some existing races. The cephalic index is based upon the proportion between the antero-posterior and transverse diameters of the brain case. It is ascertained by multiplying the transverse diameter by one hundred and dividing the result by the antero-posterior diameter; this result is the cephalic index. When it is less than eighty the skull is said to be dolichocephalic, or long-headed; when more than eighty the skull is brachycephalic, or short-headed. The antero-posterior diameter of the Neanderthal skull is eight inches, the transverse diameter 5·75 inches; the cephalic index is therefore seventy-two, and the skull is dolichocephalic, having an index less than eighty. The mean cephalic index of the existing Eskimos is 69·3.

Similar crania have been found in the tufa beds of La Denise, in Auvergne, France; at Eguisheim, in Alsace; and in the lowest gravels of the plain of Grenelle. All these are long-headed, or dolichocephalic, and correspond in other characteristics, but none are so apelike and brutal. It was therefore until recently thought that the Neanderthal man was simply a more pro-

nounced or exaggerated specimen of a general type existing at that time.

The facial bones are wanting in all these skulls, but a skull found in the Forbes quarry near Gibraltar, unfortunately of doubtful geological horizon, but with facial bones intact, coincides very closely in craniological characters with the Neanderthal skull. These facial bones are rude and massive, the upper jawbone (superior maxillary) being sensibly prognathic, the nasal bones prominent, and the nasal orifices very broad; the dental arch is of horseshoe-shape, narrowing backward.

A lower jawbone found by Dupont in the cave of Naulette in the valley of the Lesse, Belgium, has been regarded as possibly belonging to a man of the Neanderthal type. This jaw is remarkable for thickness; the molar teeth increase in size backward, the wisdom tooth being the largest; there is also an absence of the chin prominence.

In the year 1886 MM. Fraipont and Lohest, two thoroughly competent scientific men, discovered two skeletons of the Neanderthal type (a man and a woman) at the mouth of a cave in the commune of Spy, in the Belgian province of Namur.*

These men of Spy were found in the terrace in front of a limestone cave or grotto (as represented on the screen, Fig. 2, by a section through the deposit) at the point E, after cutting through the formation A, nine feet six inches (2·9 metres) thick, composed of rubble and brown clay, containing calcareous blocks of several cubic metres volume; B, a yellow argillaceous tufa, two feet seven inches (0·8 metre) thick, containing calcareous blocks and difficult to cut with a pick; C, about six inches (15 centimetres) thick, of strong red color, containing flint chippings, angular fragments of limestone, charcoal, and *débris* of mammoth tusks; D, also about six inches (0·15 metre) thick, a yellow calcareous clay passing into a tufa of same nature as B, at the base of which is a small vein of wood charcoal; F, brown clay, sometimes black, containing angular limestone pebbles and flint chippings, under which is the limestone in which the cave is formed, K.

There are no fossils in A, nor at the point where the opening is made were any found in B; but the bed B was found to be fossiliferous at other points, containing bones of mammoth and deer, and toward the upper part, in discontinuous layers, flint chippings. The zone C, above the human bones, is a hard breccia, resisting the blow of a hammer, and composed of fragments of mammoth ivory, flint chippings, angular calcareous pebbles, and pieces of wood charcoal. The continuity of this zone C, the fact

* Rech. ethnograph. sur des ossiments humaines, par Julien Fraipont et Max Lohest. Archives de Biologie, vii, 1886.

that the human bones were contained in a very hard bed, from which they were removed with difficulty, together with the careful examinations of MM. Fraipont and Lohest at the time of finding, preclude any hypothesis of burial or change of position due to reworking of strata.

FIG. 6.—SKULL OF THE MAN OF SPY. From Prof. G. F. Wright's Man and the Glacial Period. (From a photograph.)

The only logical conclusion is, that the men of Spy died at the entrance of the cave that served them for a home, on the ground that was partly formed of their kitchen *débris*. The animal remains found on a level with and below the Spy skeletons were woolly rhinoceros (abundant), fossil horse (very abundant), red deer (rare), reindeer (very rare), aurochs (plentiful), mammoth (common), cave bear (rare), badger (rare), cave hyena (abundant). The utensils found at the side of the skeletons were two triangular pointed flint instruments dressed on one face, a thin polished sandstone, many unformed flint splinters, and a bone instrument.

If we adopt the classification of Quaternary man, based on the associated fauna and archæological remains, proposed by M. de Mortillet, this man of Spy belongs to the Moustieriennes period. M. de Mortillett recognizes a Quaternary human station earlier than this, but from it there have been no human bones reported.

The two fossiliferous beds, C and B, above the skeletons, also contained archæological remains. Without taking time to describe these, it may be stated that both beds contained flints of the same type as those in the bed with the skeletons; also bone and ivory instruments. The flint instruments were more elaborate in workmanship and finish, progressively so, being more so in B than in C.

MM. Fraipont and Lohest regard the men of Spy as being of the same age and type as the Neanderthal and Cannstadt men.

The superimposed outline drawings (upon the screen) of a side and top view of the skulls, in which the solid line represents the

Neanderthal, the dotted line Spy man No. 1, and the broken line Spy man No. 2, show how closely they coincide, especially in the case of Spy man No. 1, which is scarcely distinguishable from the Neanderthal. The skull of Spy man No. 2, while retaining the general characteristics of the Neanderthal, is more arched and higher in the frontal region. The cephalic index of Spy No. 1 is seventy; that of Spy No. 2, seventy-four to seventy-six.

The immensely developed brow ridges (superciliary crests) are not known in any existing race, nor is the rapidly retreating forehead, except in rare and isolated cases. Both are well-known characters in the *Simiidæ*. The characters exhibited by the lower jaw are remarkable, and are presented by no existing human race. The angle formed by the anterior face of the mandibular symphysis with the inferior border of the horizontal ramus (that is, the angle between the chin and the lower jaw) is an obtuse angle, while in all existing races it is an acute angle. There is no chin prominence in the Spy men.

The posterior face of the mandibular symphysis (that is, separating the lower jaw at the chin and exposing the separated faces) presents characters approaching an outline intermediate between the anthropoid apes and existing man, as illustrated on the screen by outline drawings of the symphyses of the chimpanzee, Spy No. 1, Spy No. 2, and modern man. By comparing the corresponding parts as represented by the letters this will be evident. Thus the concavity P exists in the chimpanzee and Spy No. 1 and No. 2, but is scarcely discernible in existing man; the prominence G exists in the chimpanzee, Spy No. 1 and No. 2, and is scarcely discernible in existing man. The concavity T has the same relation; the prominence B, for the insertion of the genioglossal muscles, exists in all; and from this point the outline slopes rapidly forward in existing man and Spy No. 1 and No. 2, while less so and to a less defined termination in the chimpanzee. The upper part of the outline, except that it is more vertical, corresponds more nearly with the chimpanzee, while the lower part corresponds more nearly with existing man.

FIG. 7.—SKULL OF THE OLD MAN OF CRO-MAGNON, EYZIES. (Reindeer epoch.)

The absence of the chin prominence is also shown in these views. As will be noticed, the line A C, let fall from the anterior superior angle of the symphyses, falls entirely outside of the rest of the anterior outline in the chimpanzee, Spy No. 1, and Spy No. 2, while in modern man it cuts the outline, leaving a considerable prominence anterior to it.

The molar teeth increase in size posteriorly. Prof. Cope, from an examination of the teeth from casts furnished him by M. Lohest, points out many interesting peculiarities in dentition, prominent among which is the fact that the superior molar teeth are quadrituberculate. In Europeans they are generally trituberculate. In some lower races—Malays, Polynesians, and Melanesians—they are quadrituberculate, as they are also in the anthropoid apes. The bones of the forearm, radius, and ulna are so curved as to produce a wide interosseous space, not observed in any existing race, but common in apes.

The thigh bone, or femur, is round in section and curved anteriorly. This is only known among existing races in the Negritos of the Philippine Islands. It is normal among apes.

The tibia has an oval section, and is shorter in relation to the femur than in any existing race. This is also a simian character.

The condyles of the femur are wide, and are more produced posteriorly than in any existing race.

The articulation between the femur and tibia is such that the men of Spy must have walked with a fixed bend at the knees. Moreover, the body must have been bent forward in order to preserve equilibrium. These men were of short, powerful build.

In general the man of Spy presents many simian characters, but he is still distinctively a man. To use the words of MM. Fraipont and Lohest, between him and the highest apes there is "an abyss"; to which Prof. Cope adds, "though, from a zoölogical point of view, it is not a wide one."

On the other hand, this man of Spy presents characters that seem to distinctly define and separate him specifically from all other known races of men. In recognition of this fact, the name *Homo neanderthalensis* has been proposed for him.

MM. Quatrefages and Hami regard the Cannstadt man and the Neanderthal man as being of the same age and type, and have classified with them the crania found at La Denise, Eguisheim, and in the lowest gravels of the plain of Grenelle, under the name of the Cannstadt race. As before stated, MM. Fraipont and Lohest consider the Spy man to be of the same age and type, referring it also to the Cannstadt race. Of this race Quatrefages says: "It disputed the ground with the great extinct mammals, with the mammoth, the woolly rhinoceros, the cave bear, and the cave hyena; it belongs, therefore, to the earliest ages of the Qua-

ternary." Dr. Schaffhausen thinks it can be traced to an earlier period still. In view of the discovery of the Spy man with its better definition of the Cannstadt race, it is possible that the men of La Denise, Eguisheim, and the lowest gravels of Grenelle will have to be separated from this race.

In the valley of the Vézère, in the southwest of France, in that of the Somme in the northwest of France, at Grenelle near Paris, in the Gourdon grotto in the middle of the central Pyrenees, in the department of the Basses-Pyrénées, in the valley of the Meuse in Belgium, and in several other localities needless to

FIG. 8.—THE SKULL FROM THE CAVE OF ENGIS—viewed from the right side. *a*, glabella, *b*, occipital protuberance (*a* to *b*, glabello-occipital line); *c*, auditory foramen. (From Huxley's Man's Place in Nature.)

repeat here, there has been found a fossil man, morphologically much different from the Cannstadt man.

To this man MM. Quatrefages and Hami have given the name of the Cro-Magnon race, from the rock shelter of this name in the valley of the Vézère, near the village of Les Eyzies, where in the year 1858 the bones of three men, one woman, and a child were found.

This race is regarded as more recent than the Cannstadt race. The evidence to sustain this view is quite convincing.

In the Grenelle basin, near Paris, the Cannstadt man, the Cro-Magnon man, and a skeleton approaching a type known as the Furfooz man (to be described later) appear in chronological order,

superimposed one upon the other, the Cannstadt race occupying the lowest gravels, the Cro-Magnon race the alluvial beds at a depth of ten to thirteen feet, and the Furfooz race at a depth of five to eight feet.

The Cro-Magnon skull is similar to the Cannstadt in one particular only—they are both dolichocephalic, long-headed—the cephalic index of that of the old man of Cro-Magnon being 73·76, that of the Engis skull from the Meuse, Belgium, being 70·52; so that we have in both races long, narrow skulls, but here the resemblance ceases. The forehead of the Cro-Magnon skull is well proportioned, rising above brow ridges (superciliary ridges), but slightly marked in some instances, better defined in others, but never excessively prominent and apelike as in the Cannstadt skull. The vault presents fine proportions, tne calculated capacity being 96·99 cubic inches (1,590 cubic centimetres). This is higher than the mean capacity of existing European skulls.

The facial bones indicate the type of heads called by Pruner Bey disharmonic—that is, a head with a skull elongated from before backward and a face elongated from above downward is harmonic. When there is a disagreement in these proportions it is disharmonic. In this case the face is broad while the head is long. The eyes were small, the nose bold and narrow. The maxillary bones projected outward, so as to produce decided prognathism; the chin projects forward; in stature they were tall, measuring from five feet ten to six feet eight inches. All the bones of the skeleton are solid, thick, and indicate a powerful people.

In the valley of the Vézère within a distance of seven or eight miles there have been found eight settlements of this race. I will not detain you to enumerate these or describe them separately. Suffice it to say that, while the remains are all undoubtedly of the same race, the associated animal and archæological remains indicate clearly that they are not of the same age, but rather those of successive periods of development; thus the eight settlements give, as it were, an epitomized history of the race.

The most ancient, being connected by its fauna with the lower alluvium of Grenelle, the men of this period were probably little superior to the Cannstadt race. In the next settlement, that of Cro-Magnon itself, the arms and implements were more numerous and varied, though lighter and made of flint; the large animals—mammoth, bear, and hyena—were still killed for food. In other more recent settlements the cutting of flints was developed to a marvelous perfection; arrowheads, spear and lance points were made with much care and finish.

In the most recent settlements when the reindeer predominated the industry underwent a change. Bones and the antlers of reindeer were fashioned into weapons, while flint appears to have

been used for tools only. They made harpoons, barbed arrow-heads, and needles not much longer than our own, with pierced eyes. Burned wood and ashes are evidence of their knowledge of fire and perhaps cooking, though no vessels for this purpose have been found. From the needles it is a fair inference that they made clothes out of the skins of animals. They also carved with flints on the bones of animals, some of these of fair artistic merit;

FIG. 9.—DELINEATIONS ON PIECES OF ANTLER (La Madelaine). 1. Drawing of a fish on reindeer horn. 2. Representation of a squatting stag on stag horn. 3. Running reindeer on reindeer horn. 4. Piece of reindeer horn, showing on one side two heads of the aurochs, and on the other a human figure, an eel (?), two horse heads, and three rows of marks. The portions which would not be visible, owing to the roundness of the piece of horn, have been drawn beyond its contour.

most of the representations are of animals, few attempts being made at the human form, and these not good. They visited the seashore, as marine shells are found, and from the character of the burial places the inference is fair that they had some idea of a future existence.

The skeleton found in the cave of Mentone in the Mediterranean (just east of Nice) was probably of this race.

Toward the latter part of the time of the predominance of the reindeer there is a decrease in the bone implements found, and a greater finish is noted in the flint implements; no doubt, with the

amelioration of climate, retreat of the glaciers, and consequent moving northward of the reindeer, the conditions of existence materially changed. It is maintained by some naturalists that the man of Cro-Magnon followed the reindeer north, that the settlements remained for a long time uninhabited, and that the man who made the polished flint implements is another and distinct race—neolithic man, the earliest man of the present period. On the other hand, it is held that the polished flint race is but a development of the Cro-Magnon. In support of this it is claimed that in the upper levels of a rock shelter at Sorde, in the department of the Basses-Pyrénées, human bones of the Cro-Magnon type and cut flints were found, but with them a narrow, thin

FIG. 10.—PREHISTORIC MAN FROM THE CAVE OF MENTONE. (From Dana's Manual of Geology.)

blade and a triangular dagger, which are very similar to the finest productions of the neolithic age. The most plausible conclusion would seem to be that many, but not all, of the Cro-Magnon men followed the reindeer and retreating ice northward, and that those remaining amalgamated with the neolithic immigrants, accepting in a measure their industries; thus we have the mixtures of the implements of palæolithic and neolithic man.

The most recent of the races of fossil man have been grouped by MM. Quatrefages and Hami under the name of the Furfooz race, from Furfooz in the valley of the Lesse, Belgium; here a complete station, comprising a grotto where they lived and a burial grotto, was found. As before mentioned, a race allied to this is found in the Grenelle basin near Paris. Grouping on craniological characters, and considering a head found at La Touchère in a bank of the Seille as an allied form, we have in this group

four types. They are all short heads (*brachycephali*), the first Furfooz race having a cephalic index of 79·31; the second, 81·39; that of Grenelle, 83·53; that of La Touchère, 84·32. The La Touchère skull is remarkable for a disharmony the inverse of that of the Cro-Magnon. In this case the skull is broad and short while the face is long.

The two races of Furfooz have a family resemblance, but are distinctive types: in the first the head is harmonic, the forehead retreating, the face broad, a sufficiently prominent nose, square orbits, and an almost orthognathous superior maxillary; in the second Furfooz race the forehead rises somewhat perpendicularly, the orbits and the face are longer, and the superior maxillary projects forward, producing a decided prognathism. In the Grenelle race the brow ridges are full and give a slightly oblique direction to the base of the forehead, but the arc soon rises and is regular, the head is harmonic, the cheek bones are prominent, the orbits approach the square form, the nose is sufficiently prominent, and the maxillary bones are prognathous. The men of Grenelle and Furfooz were of small stature, five feet four to five feet six inches. The bones of the limbs and trunk are strong.

Some investigators are disposed to regard these Furfooz races as neolithic or belonging to recent times, but the associated animal forms seem to place them among the Quaternary forms, though perhaps near the close of the Glacial period. The remains of their handicraft would indicate a peaceable people. Their implements were made of flint and reindeer horn. Knives, saws, scrapers, and bodkins were made of the former, and lances or javelins of the latter. The workmanship was inferior to that of the most recent Cro-Magnon men. Skins were used for clothing, and their burial places indicate a belief in another life.

It is probable that this race met with the same fate as the Cro-Magnon; with the retreating ice the animals upon which they lived moved northward and to higher altitudes, the majority of the Furfooz men following, others remained stationary, and these were eventually absorbed by long-headed and short-headed men of the neolithic or polished stone period.

Pruner Bey advanced the hypothesis that this brachycephalic race were the ancestors of a so-called Mongoloid type of man, he considering that a type of man exists uniting the characters of the Mongol proper and the white races, and extending over the greater portion of the north of the old continent and even into America.

While, so far as our knowledge goes, the long-headed races antedated the short-headed, there is no evidence that the latter descended from the former. As we have seen, the long-headed Cro-Magnon and the short-headed Furfooz both had representa-

tives in the reindeer period. No doubt these fossil races, modified by intercrossing and other causes, persisted up to present times.

In this connection it may be well to refer briefly to the contention now prevailing as to the origin and original habitation of the ancestors of the present inhabitants of Europe. This subject, very interesting, is full of difficulties, which open it up to speculation and give full play to that class of scientists whom Prof. Huxley has called the Uhlans of science. Philology seems to take precedence in these investigations. The long-recognized similarity in the so-called romance languages—French, Italian, and Spanish—led Sir William Jones, about a century ago, to point out the alliance between Sanskrit, Zend, Armenian, Greek, Latin, Lithuanian, Slavonian, German, Celtic, etc. Inasmuch as the similarity of French, Italian, and Spanish would be unintelligible if it were not for Latin, so the relation between all of the above-named tongues is unintelligible without a root tongue and a people who spoke it.

At first this honor was given to Sanskrit and the inhabitants of the valley of the Ganges. Subsequent investigations demonstrated that Zend and Sanskrit were modifications of an Indo-Iranian tongue, of which Zend and Sanskrit were offshoots. Then the region of the Hindu Koosh and Pamir was thought to be the original seat; this idea crystallizing, as it were, long held sway. As the people spread northwest into Europe and southeast into India, they were called the Indo-Germanic race, and have now come to be called the Aryan race, said to be the name by which the Persians and Hindus knew themselves before their separation.

More recently speculation as to the original seat of the Aryans has, we might say, run wild. Russia, Finland, the shores of the Baltic, Scandinavia, and the Caucasian region all have or have had their advocates. The claims made for the Caucasian region and Russia appear to be the most plausible. They are, moreover, to some extent complementary to each other.

For the first locality the principal reason advanced is philological. It is held that the root language would necessarily contain names for the familiar objects of the environment. As there appear to be no words in Aryan to represent certain animals—camel, lion, and tiger—it is supposed these forms did not exist in the locality; being unknown to the people, they had no names for them. Hence, by studying the confines of animal life, a locality where the unnamed life did not exist would fill the linguistic requirement. The Caucasian region is said to do this. This reasoning is, however, of the negative kind, and is open to the objections that all negative reasoning is.

The argument for the Russian locality is known as Latham's Sarmatian hypothesis. It takes for a starting point the position that one important prerequisite for the development of the Aryan race was that in its nascent stages at least it should be kept pure. It is well known to geologists that at a not very remote period Europe and Asia Minor were continuous across the Bosporus, the barrier being about two hundred feet above the sea. Going east from this point we encounter the Black Sea, at present on a level with the Mediterranean; the Caspian, eighty-five feet above; and the Aral, one hundred and fifty-seven feet above. Therefore, at the time that Europe and Asia Minor were continuous, all this area represented by the above-mentioned seas and the intervening land was one vast sheet of water, which in connection with the mountain ranges would effectually bar the progress of a non-maritime people, thus preserving it from contamination with other races and at the same time leaving it a vast area in which to develop. If the Aryan race existed at this time, this was no doubt an ideal place for its development. Moreover, the wide area covered gave room for considerable differentiation in language before it began to spread over India and the rest of Europe, as many dialects must have prevailed, with considerable difference between those of the central tribes and those of the periphery.

When by the erosion of the Bosporus the land was drained and assumed its present condition, the race is supposed to have spread in all directions. This spreading from a central point appears, in view of the great diversity of the Aryan languages, yet all with an Aryan root, as more reasonable than the hypotheses, like that of the Caucasian region, which necessitate their spreading in successive migratory waves.

As to the origin of the Aryan race all is as yet speculation. On this point the Uhlans have the field. That there was a race or a people speaking the root tongue of all the Indo-European tongues is beyond dispute, but that all the Indo-European people speaking the so-called Aryan languages are of this race is not so clear. Whatever the truth may be as to the original seat of the Aryan race and as to its origin, they seem to be a distinct people and not to have developed from fossil or palæolithic man, as we know him, unless perhaps Pruner Bey's idea (alluded to before) may prove to be true, viz., that the Furfooz man developed into a so-called Mongoloid race, and the Aryans are a division of this race.

We have seen in some of the abodes of fossil men described that there was evidence that they had mixed and acquired some of the customs of another, more advanced, so-called neolithic race. These neolithic men may have been and possibly were the pio-

neers of the migrating Aryans, and existing Europeans are no doubt the descendants of the union of the two—the Aryan language having in great measure or entirely replaced the mother tongue, perhaps a very crude one, of fossil man. It is, however, maintained by some investigators that palæolithic or fossil man died out, and that a period or hiatus existed between his time and the peopling of Europe by neolithic man.

In America we have one skull reported from Brazil, the Lagoa Santa skull, but of doubtful geological horizon. It is, however, figured as of the Cannstadt type. In the United States we have one skull from the gold sands under Table Mountain, California, known as the Calaveras skull. This find has met with much criticism.

Weapons and implements of palæolithic man have been reported from the Pacific coast, Minnesota, Indiana, Ohio, and the Atlantic coast in the Delaware River Valley. Investigators regard this man, whose existence is proved by weapons and implements rudely fashioned of argillite, as being interglacial. Prof. Holmes has within the past two months severely criticised the Minnesota and Ohio finds. The question here also arises, What became of him? Did he follow the retreating ice northward? for it seems pretty generally agreed that the American Indian, come from where he may, is not the descendant of palæolithic man.

We saw in the first part of this paper that there was no positive evidence of man prior to the Pleistocene period; nevertheless, man must have existed before that time, for during that period his known fossil remains covered a wide area, and when we take into consideration the few fossils that are preserved by the rocks in comparison to the whole number of any species that perish, it is evident that Pleistocene man must have been numerous; and, as he must have descended from antecedent man, there can be little doubt that he existed in Pliocene and perhaps Miocene times.

There have been many attempts made to measure the age of geological strata—none, however, that can be said to be satisfactory. Not only are any experimental data that can be used very uncertain indices of what actually took place in the remote past, but the bias of the experimenter in favor of this or that hypothesis is apt to be impressed on the result attained. It may be stated, however, that scientific opinion, based on careful observations and comparative computations from these observations, the details of which our time will not permit us to go into, seems now generally agreed that the Glacial period closed from ten to fifteen thousand years ago.

We must remember that fossil man existed in preglacial or interglacial times, long anterior to the close of the Glacial period.

All or some part of that period, when North America and Europe were for the most part covered with glacial ice, intervenes between the time of man's undoubted existence—the time of the Cannstadt, Cro-Magnon, and Furfooz races—and the beginning of the time figured by these *savants*.

PROFESSOR TYNDALL.

By Prof. T. H. HUXLEY.

PERSONAL, like national, history has its epochs; brief seasons, during which life is fuller than usual, and the present is more obviously pregnant with the future than at other times. For me, the year 1851 constitutes such an epoch. In November, 1850, I had returned to England after an absence, which not only extended over a considerable period of time, but covered the critical age of transition from adolescence to full manhood. In the course of these four years, largely spent in little-explored regions of the other side of the globe, I had been in the world as well as round it, and stored up varied experiences of things and men. Moreover, I had done some bits of scientific work which, as I was pleasantly surprised to learn on my return, were better thought of than I had, I will not say expected, but ventured to hope, when I sent them home; and they provided me with an introduction to the scientific society of London. I found the new world, into which I thus suddenly dropped, extremely interesting, and its inhabitants kindly disposed toward the intruder. The veterans were civil, the younger men cordial; and it speedily dawned upon my mind that I had found the right place for myself, if I could only contrive to stop in it. As time went on, I acted upon this conviction; and, fortune greatly aiding effort, the end of it was thirty odd years of pretty hard toil, partly as an investigator and teacher in one branch of natural knowledge, and partly as a half-voluntary, half-compelled man-of-all-work for the scientific household in general.

But the year 1851 has other and even stronger claims to be counted an era in my existence. In the course of the twelve months after my return, I made acquaintances which rapidly ripened into friendships, knit with such strong bonds of mutual affection and mutual respect, that neither the ordinary vicissitudes of life, nor those oppositions in theory and practice which will arise among men of mental constitutions diverse in everything but strength of will, nor, indeed, any power short of almighty Death, has been able to sunder them from that time to this. And among those friends who, as the years rolled on,

"... mir so oft
In Noth und Trübsal beigestanden,"*

to whom, indeed, I have found the old shikaree's definition of a friend, as "a man with whom you can go tiger-hunting," strictly applicable, almost the earliest was John Tyndall.

My elder by some five years, Tyndall's very marked and vigorous personality must have long taken its final set when we foregathered in 1851. The dyer's hand is subdued to that it works in; and, it may be, that much occupation with types of structure, elsewhere, is responsible for a habit of classifying men to which I was, and am, given. But I found my new friend a difficult subject—*incertæ sedis*, as the naturalists say; in other words, hard to get into any of my pigeon-holes. Before one knew him well, it seemed possible to give an exhaustive definition of him in a string of epigrammatic antitheses, such as those in which the older historians delight to sum up the character of a king or leading statesman. Impulsive vehemence was associated with a singular power of self-control and a deep-seated reserve, not easily penetrated. Free-handed generosity lay side by side with much tenacity of insistence on any right, small or great; intense self-respect and a somewhat stern independence, with a sympathetic geniality of manner, especially toward children, with whom Tyndall was always a great favorite. Flights of imaginative rhetoric, which amused (and sometimes amazed) more phlegmatic people, proceeded from a singularly clear and hard-headed reasoner, overscrupulous, if that may be, about keeping within the strictest limits of logical demonstration; and sincere to the core. A bright and even playful companion, Tyndall had little of that quick appreciation of the humorous side of things in general, and of one's self in particular, which is as oil to the waves of life, and is a chief component of the worthier kind of tact; indeed, the best reward of the utterer of a small witticism, or play upon words, in his presence, was the blank, if benevolent, perplexity with which he received it. And I suppose that the character-sketch would be incomplete, without an explanation of its peculiarities by a reference to the mixture of two sets of hereditary tendencies, the one eminently Hibernian, the other derived from the stock of the English Bible translator and Reformer.

To those who have been privileged to become intimate with Tyndall, however, sketch and explanation will seem alike inadequate. These superficial characteristics disappeared from view, as the powerful faculties and the high purposes of the mind, on the surface of which they played, revealed themselves. And to

* ... have so often stood by me
In trouble and adversity.

those who knew him best, the impression made by even these great qualities might well be less vivid than that left by the warmth of a tenderly affectionate nature.

"If I pull through this it will be all your care, all your doing." These words (I give them from memory), uttered the night before his death, were meant for no ear but that of the tireless nurse, watcher, secretary, servant, in case of need, to whom they were addressed; and whose whole life had been, for many years, devoted to the one object of preserving that of her husband. Utterly hateful to me as are the violations of a privacy that should be sacred, now too common, I have sought and obtained permission to commit this, and take all responsibility for it. For the pitiful circumstances of Tyndall's death are known to all the world; and I think it well that all the world should be enabled to see those circumstances by the light which shines forth, alike on the dead and on the living, from the poor crumpled piece of paper on which these treasured words were, at once, recorded.

But I have wandered far from the year 1851 and its nascent friendships.

At that time Tyndall and I had long been zealous students of Carlyle's works. Sartor Resartus and the Miscellanies were among the few books devoured partly by myself, and partly by the mighty hordes of cockroaches in my cabin, during the cruise of the Rattlesnake; and my sense of obligation to their author was then, as it remains, extremely strong. Tyndall's appreciation of the seer of Chelsea was even more enthusiastic; and, in after-years, assumed a character of almost filial devotion. The grounds of our appreciation, however, were not exactly the same. My friend, I think, was disposed to regard Carlyle as a great teacher; I was rather inclined to take him as a great tonic; as a source of intellectual invigoration and moral stimulus and refreshment, rather than of theoretical or practical guidance. Half a century ago the evangelical reaction which, for a time, had braced English society was dying out, and a scum of rotten and hypocritical conventionalism clogged art, literature, science, and politics. I might quarrel with something every few paragraphs, but passing from the current platitudes to Carlyle's vigorous pages was like being transported from the stucco, pavement, and fog of a London street to one of his own breezy moors. The country was full of bowlders and bogs, to be sure, and by no means calculated for building leases; but oh the freshness and the freedom of it!

Our divergent appreciation of Carlyle foreshadowed the only serious strain to which our friendship was ever exposed. When the old Cavalier and Roundhead spirit woke up all over England

about the Jamaica revolt and Governor Eyre, I am afraid that, if things had been pushed to extremities over that unfortunate business, each of us would have been capable of sending the other to the block. But the sentence would have been accompanied by assurances of undiminished respect and affection; and I have faith that we should not have spoiled our lives by quarreling over the inevitable.

Carlyle's extraordinary peculiarities of style, even at his worst, were not, to me, the stumbling-blocks which they often proved to other people, who, in their irritation, would talk of them as affectations. Even admitting them to be indefensible, it seems to me that if he is chargeable with affectation at all (and I do not think he is), it is rather when he writes the classical English, say, of the Life of Schiller. As any one who ever heard Carlyle talk knows, the style natural to him was that of The Diamond Necklace.* These observations have a bearing on the adverse criticisms of a like kind, to which Tyndall was sometimes subjected. Modes of speech and action which some called mannerisms, or even affectations, were, in fact, entirely natural; and showed themselves in full force, sometimes with a very droll effect, in the smallest gathering of intimate friends, or with one or two on a hillside, from whom abundant chaff was the only response likely to come. I say, once more, Tyndall was not merely theoretically, but practically, above all things sincere; the necessity of doing, at all hazards, that which he judged, rightly or wrongly, to be just and proper, was the dominant note of his character; and he was influenced by it in his manner of dealing with questions which might seem, to men of the world, hardly worth taking so seriously. Of the controversies in which he became involved, some of the most troublesome were undertaken on behalf of other people who, as he conceived, had been treated with injustice. The same instinct of veracity ran through all Tyndall's scientific work. That which he knew, he knew thoroughly, had turned over on all sides, and probed through and through. Whatever subject he took up, he never rested till he had attained a clear conception of all the conditions and processes involved, or had satisfied himself that it was not attainable. And in dealing with physical problems, I really think that he, in a manner, saw the atoms and molecules, and felt their pushes and pulls. A profound distrust of all long chains of deductive reasoning (outside

* In reading the very positive conclusions, based upon differences of style, about the authorship of ancient writings, enunciated by some critics, I have sometimes wondered whether, if the two pieces to which I have alluded had come down to us as anonymous ancient manuscripts, the demonstration that they were written by different persons might not have been quite easy.

mathematics), unless the links could be experimentally or observationally tested at no long intervals, was simply another manifestation of the same fundamental quality. I was not overburdened with love for such dialectic festoon-work myself, but I owe not a little to my friend for helping to abolish as much as remained.

Once again, this quality of active veracity, the striving after knowledge as apart from hearsay, lay at the root of Tyndall's very remarkable powers of exposition, and of his wealth of experimental illustration. Hence, I take it, arose the guarded precision of the substance of a lecture or essay, which was often poetically rich, sometimes even exuberant, in form. In Sir Humphry Davy and Mr. Faraday the Royal Institution had possessed two unsurpassed models of the profound, yet popular, expositor of science. Davy was before my time, but I have often had the delight of listening to Faraday. An ineradicable tendency to think of something else makes me an excellent test-object for oratory; and he was one of the few orators whom I have heard to whom I could not choose but listen. It was no mean ordeal, therefore, to which Tyndall was subjected when he was asked to give a "Friday evening" in 1852; but he captured his hearers so completely that his appointment to the Fullerian Professoriate of Physics, with the use of a laboratory such as he needed for the original work he loved, soon followed. And for more than thirty years he held his own. From first to last, the announcement of a Friday evening by him meant a crammed theater.

Sheridan's reply to the lady who told him that his writings were such charmingly easy reading—"Easy reading, madam, is damned hard writing"—has never got into the general mind; and very few of the thousands of delighted listeners, I imagine, ever had an inkling of what these facile discourses cost the lecturer. I used to suffer rather badly from "lecture fever" myself; but I never met with anyone to whom an impending discourse was the occasion of so much mental and physical disturbance as it was to Tyndall. He was quite incapable of persuading himself, or of being persuaded by others, that, after all, a relative failure, now and then, was of no great consequence; indeed, from the point of view of pure art, might be desirable. Whatever he gave, it must be the best he had, whether it were a lecture or a dinner. Now that sort of housekeeping costs. But some think with Shakespeare:

> "The painful warrior, famoused for fight,
> After a thousand victories, once foiled,
> Is from the book of honor razèd quite,
> And all the rest forgot for which he toiled."

And Tyndall was not minded to be forgot; at any rate, for that reason.

In the autumn of 1851, my friend and I went to the meeting of the British Association at Ipswich, as scientific "items" not, indeed, wholly unknown to the "pillars" of that scientific congregation; and perhaps already regarded as young men whose disposition to keep their proper places could not, under all circumstances, be relied upon. Being young, with any amount of energy, no particular prospects, and no disposition to set about the ordinary methods of acquiring them, we could conduct ourselves with perfect freedom; and we joined very cordially in the proceedings of the "Red Lion Club," of which I had become a member in London, and which had been instituted by that most genial of anti-Philistines, Edward Forbes, as a protest against Dons and Donnishness in science. With this object, the "Red Lions" made a point of holding a feast of Spartan simplicity and anarchic constitution, with rites of a Pantagruelistic aspect, intermingled with extremely unconventional orations and queer songs, such as only Forbes could indite, by way of counterblast to the official banquets of the Association, with their high tables and what we irreverently termed "butter-boat" speeches.

*Fuimus!** The last time I feasted with the "Red Lions" I was a Don myself; the dinner was such as even daintier Dons than I might rejoice in; and I know of only one person who, under a grave, even reverend, exterior, lamented the evolution of "Red Lionism" into respectability.

It was at the Ipswich meeting, that Tyndall and I fell in with Hooker, just returned from the labors and perils of his Himalayan expedition, and who was to make a third in the little company of those who were, thenceforward, to hold fast to one another through good and evil days. Frankland had long been a friend of Tyndall's, Lubbock soon joined us; and it was we four who stood, pondering over many things, in Haslemere Churchyard the other day.

Tyndall became permanently attached to the Royal Institution in 1853, while I cast anchor in Jermyn Street, not far off, in the following year. Before reaching this settlement, we had both done our best to expatriate ourselves by becoming candidates for the chairs of Physics and of Natural History in the University of Toronto, which happened to be simultaneously vacant. These, however, were provided with other occupants. The close relations into which we were thrown, on this and many subsequent occasions, had the effect of associating us in the public mind, as if we formed a sort of firm; with results which were sometimes inconvenient and sometimes ludicrous. When my wife and I went to the United States in 1876, for example, a New York paper was good enough to announce my coming, accompanied by my "titled

* We were.

bride"—which was rather hard upon plain folk, married twenty-one years, and blessed with seven children to boot.*

My friend's exploits as a mountaineer are sufficient evidence of his extraordinary physical vigor. I could manage a fair day's work in reasonable up-and-down walking myself, but I lacked his caprine sureness of head and foot; and, when it came to climbing, I was nowhere beside him. By way of compensation, I stood the wear and tear of London life better, though I had not much to boast of, even in that respect. From the first, Tyndall suffered from sleeplessness, with the nervous irritability which is frequently cause and consequence of that distressing malady. It is not uncommon for this state of the nervous system to find a vent in fits of ill temper; but, looking back over all the long years of our close intercourse, I can not call to mind any serious manifestations of that sort in my friend. Tyndall "consumed his own smoke" better than most people, and though that faculty is worthy of the highest admiration, I suspect that the exercise of it tells a good deal upon the furnace. When things got bad with him, his one remedy was to rush off to the nearest hills and walk himself into quietude. Pleasant are the recollections, for me and others, of such hard tramps, it might be in the Lake country, or in the Isle of Wight; in the Peak of Derbyshire, or in Snowdonia. On such excursions Tyndall was the life of the party, content with everything and ready for anything, from philosophical discussion and high-flying poetics, to boyish pranks and gymnastic comicalities.

Sometimes we traveled further afield. Thus, in 1856, we made an expedition to Switzerland which had a large influence on Tyndall's future. In 1845 I had my first view of a glacier, at the head of the Lac de Gaube in the Pyrenees; and when, ten years later, I was led to interest myself seriously in geology, in connection with the study of fossils, I read all I could lay hands on about these curious rivers of ice. At the same time Tyndall was occupied with his important investigations into the effects of pressure in giving rise to lamination, and I naturally heard a good deal about what he was doing. It struck me that his work might throw some light upon the production of the veined structure of glacier ice; and one day, when he was dining with us, I mentioned the notion that had come into my head. The upshot was that we, then and there, agreed to go and look into the facts of the case for ourselves. *More suo*,† he would have nothing to do with speculation till that essential preliminary operation had been effected.

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* I have just received the report of a sermon, delivered on the 15th of December, 1893, by a curious curate, who, in his haste to besmirch the dead, abuses "the late Professor Huxley"!

† After his way.

To Switzerland accordingly we went, and I joined him at the Montanvert, where he had taken up his quarters with Dr. Hirst, who was, I think, the closest of all his friends. I have never visited the place since, but I am told that it now possesses a grand hotel. In our time there was nothing but a rough mountain auberge, opposite to which, on the glacier side of the road, was a hut for guides. Into this Tyndall moved his bed, as he could not bear the noise of the wooden house. Accommodation and fare were of the roughest; our *chef* was a singularly dirty old woman, who met all our suggestions about dinner with a monotonous "*C'est ça*" *—as if the stores of a Parisian restaurant were at her disposal—while, practically, our repasts were as uniform as her speech. But as we used to start for the Jardin, or other of the higher regions early, and rarely returned much before sunset, there was no lack of hunger sauce; while the condiment, which gives herbs a better flavor than stalled oxen, abounded. Tyndall's skill and audacity as a climber were often displayed in these excursions. On one occasion, I remember, we came upon a perpendicular cliff of ice of considerable height, formed on the flank of the glacier, which seemed to present a good opportunity for the examination of the structure of the interior. A hot sun loosening them, the stones on the surface of the glacier every now and then rattled down the face of the cliff. As no persuasion of ours could prevent Tyndall from ascending the cliff, by cutting steps with his axe, in order to get a close view of the ice, we had to content ourselves with the post assigned to us, of looking out for stones. Whenever any of these seemed likely to shoot too close we shouted, and Tyndall flattened himself against the cliff. Happily, no harm ensued; but I confess I was greatly relieved when my friend descended at his own pleasure, and not at that of a chance fragment of rock.

It was on this trip that we attempted the ascent of Mont Blanc direct from the Montanvert, with a couple of porters to carry the needful stores as far as the Grands Mulets; and a guide, who, as it turned out, was of the blind sort. I found I was by no means in training; and as, under the circumstances, any failure on my part would have obliged the others to give up the attempt, I determined to remain at the Grands Mulets. My friends and the guide set out before dawn, and should have been back in eight or ten hours at furthest. The weather was magnificent, and I should be puzzled to recall a morning spent in more entire enjoyment than that yielded by the wide and varied prospect from my temporary hermitage, in a solitude broken only now and then by a vagabond butterfly or a strayed bee, drifting upward. But when

* Which might be translated "All right."

the early hours of the afternoon glided away without any sign of my companions, and the sun got low, things began to look serious. Neither the people at the Montanvert, nor those at Chamounix, knew anything about our intentions. In our way from the Montanvert we had had to cross some troublesome crevasses, and I knew nothing about the route down to Chamounix. If any accident had happened to my friends I could not help them; nor could I reckon upon getting assistance from Chamounix, unless, perhaps, I set fire to the timbers which sheltered me. My anxiety and perplexity may be imagined, and at last, as it grew colder, I went into the hut to ponder over the situation. As I sat over the embers, trying to see my way to some clear conclusion, I suddenly heard the clink of an alpenstock upon the rock at the foot of the Grands Mulets. The sound has ever since been pleasant to my ear; and, rushing out, I saw the three slowly making their way up—Tyndall pretty well exhausted, for the first and last time I ever saw him in that condition; Hirst snow-blind; and the guide thoroughly used up. He had mistaken the route and led the party into all sorts of superfluous difficulties.

As we intended to have descended to Chamounix, without stopping a second night at the Grands Mulets, provisions were not over-abundant and there were no candles. I am proud to say I made myself useful in various ways; among other functions, performing that of a chandelier with a perpetual succession of lighted lucifer matches. We were soon a merry company; and the next day we descended in glory, to the great disgust of the orthodox guides of Chamounix, to whom an ascent of Mont Blanc, up to that time, had meant the organization of a large and profitable expedition.

The love for Alpine scenery and Alpine climbing, which remained with Tyndall to the last, began, or at any rate became intensified into a passion, with this journey; and, at the same time, he laid the foundations of his well-known and highly important work upon glaciers and glacier movement. His first paper on this subject was presented to the Royal Society in 1857, and bears my name as well as his own, in spite of all my protests to the contrary. For beyond two or three little observations, and perhaps some criticism, I contributed nothing toward it, and all that is important is Tyndall's own. But he was singularly scrupulous—even punctilious—on points of scientific honor. It would have been intolerable to him to have it supposed that he had used even suggestions of others, without acknowledgment; so I, being thicker skinned, put up with the possibility of being considered a daw in borrowed plumes. The memoir became the starting-point of a long and hot controversy. While it was at its height, some supporters of the other side endeavored to throw the

weight of the award of one of the Royal Society's medals into the scale against Tyndall. It seemed to some of his friends, myself among the number, that this was unfair; and a lively battle, eventually decided in our favor, took place in the Council of the Society. I refer to these old troubles, merely for the purpose of finally removing the impression, if any such remains, that Tyndall had anything, directly or indirectly, to do with what took place. On the contrary, the two persons who were chiefly responsible, thought it desirable that he should be absolutely ignorant of what was going on; and I can answer for it that he remained so until long after, when, rummaging among my papers, I found some documents which I labeled "Ashes of an old fire," and sent to him.

Tyndall was a highly esteemed and popular member of the Royal Society and always loyal toward it; but the sensitiveness to which I have alluded led him, very early in his career, to do what, so far as I know, nobody had done before, nor has done since. In 1853, the Society awarded one of the two royal medals to him, the other recipient being Charles Darwin. Unluckily, one of the members of the Council, a person of high scientific position, who had wished to dispose of the medal otherwise, took his defeat badly; and, being a voluble talker, exhaled his griefs with copious impropriety to all and sundry. As soon as the report of this reached Tyndall's ears, he wrote a polite note to the senior secretary declining the honor. Frankly, I think my friend made a mistake. The Council was in no way responsible for the ill-judged and, indeed, indecent proceedings of one of its members; and perhaps it is better to leave an enemy alone than to strike at him with the risk of hurting one's friends. But, having thus sacrificed at the altar of strict justice, I must add that, for a young man starting in the world, to whom such recognition was of great importance, I think it was a good sort of mistake, not likely to do harm by creating too many imitators.

As time went on, as the work became harder, and the distractions of life more engrossing, a few of us, who had long been intimate, found we were drifting apart; and, to counteract that tendency, we agreed to dine together once a month. I think, originally, there was some vague notion of associating representatives of each branch of science; at any rate, the nine who eventually came together—Mr. Busk, Dr. Frankland, Dr. Hirst, Sir Joseph Hooker, Sir John Lubbock, Mr. Spencer, Mr. Spottiswoode, Tyndall and myself—could have managed, among us, to contribute most of the articles to a scientific encyclopædia. At starting, our minds were terribly exercised over the name and constitution of our society. As opinions on this grave matter were no less numerous than the members—indeed, more so—we finally ac-

cepted the happy suggestion of our mathematicians to call it the x Club; and the proposal of some genius among us, that we should have no rules, save the unwritten law not to have any, was carried by acclamation. Later on, there were attempts to add other members, which at last became wearisome, and had to be arrested by the agreement that no proposition of that kind should be entertained, unless the name of the new member suggested contained all the consonants absent from the names of the old ones. In the lack of Slavonic friends this decision put an end to the possibility of increase. Once in the year there was an outing, to which our respective wives were invited.

If I remember rightly, the meetings of the x Club began early in the sixties. They were steadily continued for some twenty years, before our ranks began to thin; and, one by one, "*geistige Naturen*" (departed spirits), such as those for which the poet* so willingly paid the ferryman, silent but not unregarded, took the vacated places. Tyndall was a constant attendant and a great promoter of vivacious conversation, until his health failed. Two years ago, a deep gloom was cast over one of our meetings by the receipt of a telegram to the effect that he had but few hours to live, and his partial recovery, at that time, was a marvel to all who knew his condition. I believe that the "x" had the credit of being a sort of scientific caucus, or ring, with some people. In fact, two distinguished scientific colleagues of mine once carried on a conversation (which I gravely ignored) across me, in the smoking room of the Athenæum, to this effect: "I say, A, do you know anything about the x Club?" "Oh, yes, B, I have heard of it. What do they do?" "Well, they govern scientific affairs; and really, on the whole, they don't do it badly." If my good friends could only have been present at a few of our meetings, they would have formed a much less exalted idea of us, and would, I fear, have been much shocked at the sadly frivolous tone of our ordinary conversation. Assuredly Tyndall did not usually help us to be serious.

But I must bring these brief and too hurried reminiscences to a close. I believe that ample materials exist, and will be used, for a fitting biography: indeed, the putting these materials into autobiographical form was the final piece of work to which Tyn-

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* "Nimm dann Fährmann,
Nimm die Miethe
Die ich gerne dreifach biete:
Zwei, die eben überfuhren,
Waren geistige Naturen."

Take, ferryman,
Take triple fare,
Which I freely offer thee;
Two who just went over
Were departed spirits.

I quote from memory; but it is long since I read these verses, and more likely than not the citation errs.

dall, with his wife's aid, proposed to devote himself. With the exception of the investigations upon the aërial germs, which, though, strictly speaking, they might be continuations and amplifications of Pasteur's labors, yet had a very great effect in putting an end to the tough-lived speculations of the advocates of the so-called "spontaneous generation" hypothesis, Tyndall's later scientific labors do not lie within the competence of my judgment. On that point, I leave it to contemporary experts to speak; and to time to give the final verdict, which is not always such as contemporaries imagine.

Neither do I offer any remark about Tyndall's philosophical, religious, and political views; in respect of which my opinions might possibly be impartial; but nobody would believe that they were so.

All that I have proposed to myself, in writing these few pages, is to illustrate and emphasize the fact that, in Tyndall, we have all lost a man of rare and strong individuality; one who, by sheer force of character and intellect, without advantages of education or extraneous aid—perhaps, in spite of some peculiarities of that character—made his way to a position, in some ways unique; to a place in the front rank not only of scientific workers, but of writers and speakers. And, on my own account, I have desired to utter a few parting words of affection for the man of pure and high aims, whom I am the better for having known; for the friend, whose sympathy and support were sure, in all the trials and troubles of forty years' wandering through this wilderness of a world.—*Nineteenth Century.*

THE EUROPEAN LAW OF TORTURE.

By AMHERST W. BARBER.

IT is a startling anachronism to an American reader of 1894 to stumble upon a large vellum-bound law-book of the last century, prescribing in minute detail all the rules and conditions that must attend the proper infliction of intense physical pain on persons merely accused of any offense, and containing an appendix full of engravings, given by royal authority as working drawings to govern every operation of legal torture. Such a relic of an almost forgotten system of law rests in obscurity at the national capital, intruding its grim savagery of language and its coldly fiendish pictures upon a few minds accustomed to the modern idea of gentleness to every living being.

This book, printed in obsolete and barbaric German, with marginal syllabus in monastic Latin, seizes on the mind with a grasp of horror, and brings back the reader again and again to

delve among its dry bones of ancient delusion and wrong. It reveals a wide field of ideas which not long ago ruled the "civilized" world, but now are forever put away. In fact, it exhibits with photographic accuracy the Inquisition of central Europe.

The prevalent idea of torture seems to be about as follows: That two or three centuries ago a wicked portion of a priesthood set up the Inquisition as a means of religious persecution, which, after all, was probably not nearly as bad as reported. Another class, somewhat better informed, can discourse at large of the Spanish and German Inquisitions, and describe their ghastly relics still shown in museums; while others, again, full of ignorant zeal, will denounce the whole subject as a base slander on human nature.

But comparatively few now realize the full truth that in various lands torture was the established method of authority to force prisoners to convict themselves of every sort of crime for more than a thousand years before the Holy Office was set up by churchmen; that it still survived in parts of Europe as an authorized court process for generations after they had abolished the Holy Office; and that the much-advertised doings of the Inquisition were but a few rough waves of that bloody ocean of wrong which flowed over Europe from the time of Herodotus down to the nineteenth century.

Books of reference give the facts mildly, softened from old authors inaccessible to the many. But one must beware of history written, perhaps, for partisan purposes or with sectarian bias. What is wanted to-day is scientific proof, impartial and unimpeachable. For this is a delicate matter of family history. In examining into the mental and moral condition of ancestors only three or four generations back, let us beware of hearsay evidence. But we shall be justified in the inquiry if we can obtain their own testimony and make them convict themselves in their own favorite style.

For this purpose the *Constitutio Criminalis Theresiana*, or criminal code of Austria and Hungary, put forth in 1769 under the imperial edict of Maria Theresa toward the close of her reign, outweighs a whole library of recent suppositions. This book contains three hundred and fifty folio pages, with one hundred and four articles or chapters arranged in two parts, prefaced by a lofty proclamation over her Majesty's hand and seal, ordaining and enacting it as the lawful code of her domain.

Part I is a general commentary upon crime and criminal process, beginning with this benevolent and modern principle: "The punishment of criminals is designed chiefly for the reformation of evil-doers." The subject of torture is reached in Article 38, where eleven large pages are devoted to an exhaustive treatise on its principles and practice. It is called in the text "*die pein-*

liche Frage," or the painful questioning. In this code of explicit directions reference is made to the pictures in the appendix, showing all the authorized apparatus for torture. They are drawn, lettered, and explained with the exactness of a patent drawing, and were not to be varied from in the least detail by the judicial operators. This treatise begins with the fundamental definition: "Torture is a lawful means of compulsion to bring to confession a denying malefactor, who, in the absence of full proof, has been strongly accused—or perchance to clear him from a burden of suspicion and accusation." This is paraphrased in the Latin note by saying that torture is a subsidiary means of tearing out the truth (*eruendæ veritatem*).

Part II takes up the whole calendar of crimes, arranged in forty-eight distinct classes, giving to each a brief separate treatise combining principles, law, exceptions, penalties, and questions to be used in the trial. More than three fourths of these chapters specially prescribe torture to make the accused convict himself. From blasphemy, the greatest crime in the list, down to the most trivial, a suspected person could in nearly every case be visited with deathly torment upon mere suspicion.

Human progress exhibits no contrast more surprising than is seen between the mercifulness of to-day and the cruelty of the past. What do we now observe as proofs that mankind does not now approve nor enjoy the bodily suffering of fellow-creatures? Human slavery largely abolished, with the stocks and whipping post; cruel punishments prohibited by the Constitution; capital punishment done away in various sections; painless execution introduced; all minor penalties reduced to fines and restraint of liberty, with good sanitation of prisons; anæsthetic medical treatment everywhere in use; corporal punishment in schools becoming unfashionable; humane societies interfering to prevent ill treatment of children and dumb beasts; and, especially, we see prisoners on trial permitted to sit unfettered and at ease, attended by weeping relatives to excite sympathy; allowed unequal advantages over the prosecution in the selection of a jury; given the benefit of every doubt, often of the most fictitious; furnished all opportunities for acquittal which money and dishonest counsel can procure; allowed to testify in their own behalf; and never required to give an answer that would tend to criminate themselves.

In contrast with this picture, take the manner of conducting trials under the elaborate rules laid down in the Theresian code. A man accused of felony, such as arson, sedition, sorcery, or poisoning, must be arrested, jailed, and brought to trial. If two or more so-called witnesses made oath that they believed him guilty, though no positive proof could be found, the court decreed it a *casus torturæ*, a proper case for torture, and proceeded to apply some pre-

scribed form of physical pain. An engraving shows one of the moderate methods. The victim's wrists are crossed behind the back and tied with a strong cord attached to a rope which passes over a pulley in the ceiling and down to a windlass. The *Henkersknecht*, or hangman's assistant, turns the windlass and the arms are strained upward, while the *Scharfrichter* (sharp judge, executioner) fiercely propounds the list of questions laid down in the code. In a trial for poisoning, for instance:

"Did you or did you not administer the poison that killed A. B.?

"When and where did you do it?

"For what reason?

"Who assisted or advised it?

"Who was present at the time?

"What sort of poison was it?

"Where and how did you procure it?

"Did the apothecary know your intended purpose?

"Have you ever poisoned others, or attempted it?

"What were the effects on the deceased?

"How long did he live after it? Was the body swollen? Did the nails turn blue or black? Did he froth at the mouth?" *Et cetera.*

The person undergoing torture (*der Inquisit*) of course stoutly denies each charge; so the servant gradually hoists him till he swings clear of the floor, with his arms undergoing backward dislocation, and the questions are thundered in his ears again and again as he whirls in dizzy agony. If able to persist in denial he is lowered for a brief rest, then raised again with a twenty-five-pound weight attached to the cord that bound his ankles, and the questions are repeated. If the man has unusual strength of body and will, he may still remain obdurate; in which case Theresa's code requires a third hoisting with a forty-six-pound weight added. This may or may not draw from his screeching lips words of confession, which the eager scribe will record, to seal his fate on the gallows or at the stake; but it can hardly fail to cripple him for life.

This is but one of the many ways enacted and vividly depicted in this code for "tearing out the truth," or "putting him to the question," as Shakespeare and other English writers denominate similar practices of our ancestors; for *quæstio* (seeking or inquiry) was the mild legal term for such proceedings ever since the days of ancient Rome. Wherever Roman conquests spread and the code of Justinian was fastened upon new possessions, there the torture system was ingrafted. Perhaps it was nothing new to the Gauls and Germans, but Greece and Rome are generally held responsible for its wide prevalence in ancient times.

The dangerous privilege of using these "methods for the discovery of truth" was greatly abused, and often carried to a fatal extreme. Through ages of unrecorded tyranny the party in power put down its enemies and all opposing thought by such unbridled cruelty as no one now cares to contemplate. The public conscience seemed to approve the principle of torture as a divine prerogative of kings. Barons, judges, priests—in brief, all great robbers and politicians—cherished it. The more humane monarchs, such as the Empress Theresa, could only limit its cruelties by precise and moderate safeguards, exempting from all torture the sick and feeble, the old men, pregnant women, young children, and weak-minded, and providing that medical and surgical skill be always at hand to restore those who are near death, and reduce dislocations or fractures.

In some of the histories and cyclopædias are misleading statements that torture was abolished from the Austrian dominions about the middle of the last century, whereas this Austrian code was promulgated nineteen years later. Again, it is recorded of Maria Theresa, after an account of her general European war of seven years, ending in 1748, that "she now turned her attention to the internal affairs of her states. She introduced numerous reforms, alleviated the burdens of the peasantry, abolished torture, and promoted industry." Her code, however, proves otherwise; for she had reigned twenty-one years after the peace of 1748 when she re-enacted these laws to perpetuate these terrible outrages on human justice. Whether she abolished it at all in the remaining ten years of her life is open to doubt. Other statements from the same sources, regarding the continuance and decline of the Holy Inquisition, appear equally questionable.

The study of such customs suggests strange and difficult questions. What sort of minds had those people? Did they possess conscience? If so, was it anything like the conscience of the moderns, who cherish the same sacred books? Was human justice then a false moral guide? Is it a true one now? Is human nature the same from age to age, or can it reverse itself while standing on the same basis? Was the woman-heart tender and sympathetic in those days? Or what sort of women reared the monsters who kept up torture for twenty centuries?

The persistence of that legal crime, in spite of all the morals, philosophies, and religions that held sway through those ages, is a hard and stubborn fact. Its phenomena seem to fit no favorite theory of general progress. What a world of intellectual power, of tender morality, of spiritual zeal, has blazed as with heavenly fire through those ages of unjust torment, without taking any concern in that system! It stood forth above all such influences like an upheaval of archaic rock which all the tides and storms of

progress had been powerless to beat down. Grecian culture and beauty did not care to assuage one pain. The magnanimity of Roman power did not hold out one merciful reform toward the suspected offender. Cicero wrote against the system, but all in vain.

The young nobility and students of Europe, flocking to great universities like Salerno in the middle ages, and learning from imported Arabic professors from milder Asia, do not seem to have acquired any noble horror of human cruelty. New religious sects arose and competed for public favor, but all were more ready to use torture than to condemn it. The leading minds of Europe were full of the New Testament, but they did not find legal torture referred to therein. Only the command not to suffer a witch to live seemed to fit the case.

A theory is greatly needed to harmonize these incongruous facts—a bright, clear, comprehensive, optimistic theory, creditable alike to humanity and the forces which guide human development. But such an explanation is not readily found. In default of a broad and able-bodied theory, fitted to carry us over all difficulties, one is left floundering among some unpleasant reflections. All races may have risen from barbarism. Before barbarism they may—just possibly—have come up from a still more brutish state. Yet this instinct of enjoying the torture of others can hardly be called a survival of brutishness, since animals do not seem to consciously practice cruelty; it is rather a distinguishing trait of mankind.

This element of savagery is a most persistent and incorrigible offender in the happy family of our virtues. How it has defied culture, development, moral training! In theory all advancing races should properly have this Canada thistle of our moral field pretty well eradicated by this time by the strong hand of social and religious development. But when it has been well dug out, burned up, and killed very dead, the weary reformer, resting on his hoe, sees the thorny shoots of human cruelty here and there pushing boldly up in new places, fresh from the ancient seeds of inherited brutality that still lurk in the soil. Yet he cheerfully begins anew, and attacks the inexhaustible evil with never-tiring zeal.

It is also depressing to reflect that all men have been savages in infancy; that children pass through the ascending grades of mere animal life; that each young pupil, rightly observed, has been a sample of slow or rapid evolution through the stages of cave-dweller, nomad, and barbarian, to the half-civilized or even a higher grade. The childhood of races reflects the development of individuals. In the rapid march of the infant mind there comes a time when it gives pleasure to see and produce suffering.

This part of the regular course is omitted by few, and in some cases is adopted as a ruling life-trait. This was probably the usual result in those early days.

Another discouraging obstacle to any pleasant theory is that apelike propensity for imitation which kept primitive races following the old tracks of their predecessors. Antiquated custom gave them inviolable laws, against which reason and justice might protest in vain. The mere imitative trait has sometimes ruled the action and belief of masses of mankind as surely and unthinkingly as it does a colony of the simian tribe or a community of cigarette-using boys.

A race of beings so tainted with original savagery, so ruled by imitation, and so averse to change, must have found it hard to abolish torture from the court-room. To accomplish the reform one of the grandest moral battles of the world had to be fought. An ethical rebellion against the allied powers of monarchy, hierarchy, and aristocracy had to be triumphantly carried through. Necessarily there were brave leaders, who went into the fray with their eyes open to the fate of Jerome and Huss, of an earlier age, who for having dared attack the sin of torture were burned alive by the offended Church.

It was but recently, speaking comparatively, that the Inquisition, both secular and ecclesiastical, was in full force, and that the reform mentioned was made successful. When the code before us was printed at Vienna, the present writer's grandfather was a youth of thirteen years. America was then already reformed from her imported sins against justice. The whirlwind of delusion which culminated at Salem had been over for seventy-seven years, and its reaction had blotted from the minds of most Americans much of the witch-belief of former ages. Benjamin Franklin had long been the ambassador of America to his king, pleading for political rights. England had partly reformed her cruel laws. Human torture was not legal in America, save under the cloak of African slavery.

Yet in the Theresian code, Article 38 is found filling eleven broad pages with the law of torture, as if it were a fundamental institution which would exist forever. It specifies the cases in which courts are warranted in using torture to induce confession, which seem worth giving in full:

When one is accused by one credible, sworn witness, aided by evidence of previous bad character.

When, after detection in the act, he boldly denies it.

When informed against by an accomplice.

When he has admitted the offense which was known to be committed.

When any two or more of the following causes concur to

show guilt, though singly they are not sufficient to incur torture, such as—

Previous bad character or worthless conduct.

Previous similar misdemeanors, either proved or rumored.

Being found in proximity to the crime.

Being seen with the appearance, dress, arms, or horse of the actual culprit, or approaching or leaving the spot.

The finding of any of his dress or weapons, or of his tracks in snow or earth.

His previous companionship or domicile with those who commit such acts.

Previous enmity, envy, or threats toward the injured person.

Dying declarations or sworn accusation by a person injured.

Absconding suddenly without good cause.

Altering his personal appearance, disguising, giving false excuses, etc.

To entitle the prosecution to obtain a decree for full torture of one accused of a capital crime (and most of the offenses were then capital), two or more of the above conditions must be shown to the satisfaction of the judge. The warrant must specify not only how many of the successive grades may be used, but just how long each process shall be applied. But in every case of torture a strange preliminary proceeding was required, called territion (*territio, Schreckung*), a mental torture, by terrifying the prisoner to extort confession through fear of pain. It was derived, like all the rest, from the ancients, whose law writers prescribed forms similar to those of the Austrian code.

Territion was of two grades—verbal and real. In verbal territion the judge exhorts the prisoner to confess, and tells him what pains await him; he describes the process vividly, with the executioner acting the scene in pantomime. The victim is fiercely seized by the hangman, dragged from the court-room down into the place of torment (*Marter-ort*), and shown the painful machines and their use. The executioner seizes him again and pretends to be about to apply them.

Verbal territion failing to secure admission of guilt, he resorts to the real. He seizes the *Inquisit* once more, drags him to the rack, binds him in place, but does not apply the ropes or screws to any painful extent. Returning him then to the court-room, they again solemnly warn him to confess his guilt, lest worse shall befall him. If he still remains obdurate, his day of grace is past; territion gives place to actual torture.

The code gives a few merciful limitations of this power. Idiots, invalids, feeble men over sixty, children, and, of course, all officials and clergy, are exempt; and women can only be subjected

to the two milder grades, the other two being reserved for men accused of atrocious crimes.

Then comes a minute and intricate code of procedure for those very common and puzzling cases when the sufferer pleads guilty under torture, but reasserts his innocence after it, declaring that the pain irresistibly drove him to make a false confession to obtain a brief respite. In such cases the judge is forbidden to "put him to the question" anew till he has certified the conflicting statements to a higher court, and received new orders to proceed. But the good empress commands that "beyond three times shall no one be tortured; but he who endures it three times without confession, or who has each time recanted his confession, shall be set at liberty, because he is sufficiently cleansed from the accusations by the martyrdom endured. And the martyr can not say that injustice was done him, for the judge has the evidence to justify his action," etc.

The four grades are then defined, the first being the thumbscrew (*polletrum, Daumstöcke*). Two separate forms are pictured by life-size scale drawings; one sort was legal in Austria and one in Bohemia. It is a strong little vise, seven inches long, of two flat iron bars connected by screw bolts. The thumbs are to be inserted to the first joint, and the inner surfaces are armed with toothlike points. While the questions are asked one servant helps hold the vise and turn the nuts with a wrench or key, while another clasps the victim tight around the body to prevent contortions. A third may or may not be employed to increase the pain by hammering on the vise.

The picture of this scene is very effectively drawn. The conflict of stubborn wills between the roaring victim and the iron-hearted bailiffs is fearful to witness. The judge is in no hurry; he gives the wrench an additional turn now and then till the very bones are crushed, and the clerk can triumphantly write down the confession of guilt.

The second grade, which is now seldom heard of, was the cord (*fidicula*). Its exact size and use are fully pictured. The arms of the accused are stretched forward with the palms together. A strong rope, like sash-cord, is looped upon the wrist, then wound tightly round both arms to the elbows, cutting deep into the flesh and tending to break the elbow joints. This was regarded more terrible than the thumb stocks. This was the Bohemian method; but another form was prescribed for Austria equally effective and ingenious.

The famous rack, which comprised the third grade, was of great utility in the "discovery of the truth." It was called *equuleus*, or little horse, by the Austrian as well as the Roman jurists. Four full-page engravings depict the exact form, size, mechani-

cal construction, and practical use of this machine. It is a wide ladder of two strong poles with many rounds, and is fixed in a slanting position from the stone floor to the dungeon wall. The culprit must climb to the upper part and sit down; his wrists, previously bound behind his back, are tied to the fifth round. His feet are bound with a rope, which is drawn down by a windlass attached to the base of the ladder. As he is pulled downward his arms are twisted upward behind him. When fully carried out the desired result was complete dislocation of the shoulders, as the explanatory notes declare with great exactness of detail.

The *Scharfrichter* must stand on the rack beside the *Inquisit*, keeping one hand on the breast and one on the back to watch his vital condition; as his accusations are persistently denied, he signals to the windlass-man to apply more force, till at last the arms are wrenched into a straight line with the body, tearing the ligaments and breast muscles from their attachments. Then, if the martyr is a hero who can endure still more without denying his faith, the judge may proceed to the fourth grade, if in Bohemia, though it was forbidden in Austria.

The final grade, *ignis*, or burning, is figured by several cuts, showing torches of candles bound together, eight in each torch, lighted and burning brightly, which the tormentor, bending over his broken victim, applies to the naked sides of the chest until a space about seven inches in diameter is burned to a blackened crisp. The law strictly forbids burning a larger space, or any other region of the body; but it allows the assistants to aggravate the anguish of suspension and of racking by beating with scourges.

These four grades are extended by equivalent tortures of other forms, such as the *Spanische Stiefel*, or iron boots. Two broad iron plates, curved to fit the shin and calf and extending between the knee and ankle, are connected by screw bolts at the margin to compress them together. The inner surface of each is studded by thirty blunt nails, half an inch long, to be forced into the flesh and bones. To increase the pain in special cases these plates may be hammered upon. One of the most realistic engravings shows a group of inquisitors applying this boot to an old man, who seems visibly shrieking for relief by death.

Yet there was one heinous sin for which torture had no terrors. Suicide had need of a different chapter in our book of justice. When some poor hunted soul had broken the jail of the body, driven from the certain cruelties of this life to the imagined terrors of the next, the torturers were exasperated and disappointed; yet something must be done to relieve their brutal fury, just as the mob of to-day invariably "riddles with bullets" the corpse of its victim. The chapter on suicide proclaims the great

double sin of the deceased, denies him respectable burial (*honesta sepultus*), and dooms the poor remains to dog-burial (*canina sepultus*) at some cross-roads, with or without a stake driven through. It then proceeds to render his family infamous by attainder and to impoverish his heirs by confiscation of all their property. There being nothing left to destroy, Theresa's code here suspends hostilities against the suicide.

In the gradation of crimes, blasphemy was held infinitely worse than all others; while second in enormity was apostasy from the ruling faith. This is carefully limited to those who have been within the fold and have backslidden, thus excluding the different offense of heresy. The omission of heresy from the book shows that it fell within the special province of ecclesiastical courts, or else that there was a glimmering of spiritual toleration in those days.

The third great class of crimes, transcending in awfulness treason, murder, and all that follow, comprised the imaginary delusions called magic, witchcraft, and sorcery. There is an extreme effort made in this chapter by the solemn wise men of 1769 to be very judicious, calm, and reasonable. A full translation of this treatise on the ghastly joke called witchcraft, would form an exquisite satire on the self-complacent wisdom of that or any other age. It enjoins on judges great care to avoid the errors and foolish superstitions of the ignorant lower classes, and warns them never to convict, except upon positive proof that the accused is a genuine witch or sorcerer. It argues and establishes the actual existence of the black art, the evil eye, and possession by devils. Then it sets all the wheels and screws of torture at work against "all those God-forgetting wretches who commune with the devil, raise great storms, bring about cattle-plagues, or go sailing through the sky upon a goat."

The forty-odd other classes of crimes follow in descending order, each having a little chapter containing its special code and commentary, with the following usual subdivisions:

Definition and general principles of the offense.

Different gradations of its enormity.

Amount and character of evidence necessary for issuing the warrant and arresting the suspect.

Evidence requisite to show probability of guilt and justify use of torture on trial to secure confession.

List of special interrogatories for each crime, to be used before and during torture.

General and special directions to the magistrate for unusual cases.

List of possible circumstances tending to aggravate the offense and calling for additional severity.

List of possible mitigating circumstances under which prosecution may be relaxed and penalties reduced.

Scale of punishments for different grades, and forms to be used in pronouncing sentence, after torture and conviction.

The irrepressible savage love of causing pain was shown by the methods of execution as well as those of examination and trial. A translation of the prescribed forms of final judgment exhibits a tediously elaborate array of fiendish methods to make death slow and agonizing, and strike terror into myriads of beholders. Though foreign to our present topic, they illustrate the ruling passion of that age.

The chapter on allowing the accused the privilege of attorney and defense, begins with the fine assertion that defense is to be denied to no one. Then comes an intricate list of conditions and exceptions, which narrows the privilege to a very small chance. The final condition, however, might well be adopted for the reform of modern courts: "Before the *defensor* takes up the case of a prisoner, he shall bind himself not to act dishonestly to suppress the truth, but to do everything *in bona fide*."

To determine guilt or innocence, the ancients—that is, savage races in general—have used all sorts of divination, more or less senseless or cunning. There were water tests, fire tests, poison tests, and exposure to wild beasts. One favorite fashion was by single combat, which has degenerated into the modern duel. The wager of battle, like all the rest, presumed the idea that the Deity would interfere to protect the guiltless. Races sprung from Viking stock were especially liable to this error, which even to-day is firmly rooted in the minds of whole nations when pugnaciously disposed.

In trying to account for judicial torture, some have held it a sequel and substitute for the wager of battle, showing a moral advance of ideas in the growth of the nation. But this theory hardly fits with the great antiquity and wide extent of the system. If torture was a sequel of the judicial duel, then it was a case of retrograde evolution; for the high moral features of the combat, such as faith in divine help, trust in a just cause, fair play, and championship of the innocent, were thrown aside. They were exchanged for a system of mean, cowardly cruelty, all the power of the rulers working out hatred upon one defenseless prisoner in the secrecy and safety of a dungeon vault.

It is also idle to claim that torture was based on that sophism credited to Jesuits of old, that it was lawful to do evil to attain a good result; for torture was ancient before Loyola began his work. On the other hand, it is idle to make the common assertion that all progress, conscience, and mercy were conferred on the world by some particular religious system or event. For it

was such a system which maintained the tortures portrayed in the Theresian code, and which, during centuries of supreme control, had sole power to remove the curse, yet never took a step in that direction till driven by outside pressure.

There is a great work to be written by some student who can relate the decline and fall of that engine of tyranny. Many nations successively were freed from its terrors. It was a long and bitter war between the allied powers of kings and priests, and the true lovers of humanity. It was a secret war of ideas, and its weapons were the clandestine publications of daring freethinkers, secretly translated and circulated over Europe at the risk of a lingering death in the torture chamber.

Such a work would be a history full of joyous reading. One would fain learn everything about Beccaria, the first and greatest successful mover in that holy cause. We would confer all due honor upon Hommel, Voltaire, Howard, and those who helped spread the great Italian's burning words over the continent. Our copy of Theresa's code was printed five years after Beccaria had issued his great work for the abolition of capital punishment and torture. The conflict of the age had begun, but the great empress knew or heeded it not.

The old system left its marks on our language. Persistent questioning is called "inquisitive," and when one's acts are put under sharp inquiry they are "called in question." People who do not know what the rack was, complain of racking pains. Ladies "suffer excruciatingly," without thinking of the myriads who have really been excruciated, or put to death on the cross. The word *torquere*, applied by the Latins to the twisting of human limbs, gave us such words as torture, torment, and extortion. Ladies may now be called "bewitching" without being accused of actual dealings with Satan. In short, words once of deadly import are now the weakest of hyperbole.

Since these reforms of ancient abuses became universal, their ideas have been extended in America to an unwise and absurd degree. Sentimental mercy has not only destroyed the efficiency of courts of justice, but has impaired national confidence in them. A second reaction takes place, from the false mercy of maudlin sympathy with crime, to the deliberate and lawless fury of mobs and lynchers. The prevention of cruelty to animals is an absorbing "fad" with some who would not concern themselves with the heart-breaking tyranny of a drunken husband in the nearest house.

Yet evolution works steadily on. Whether it be a hundred years hence or a million, the day may come when every mortal in his strength and pride will be too noble to torment the weak or helpless.

CUSTOMS AND SUPERSTITIONS OF THE MAYAS.

By Mrs. A. D. LE PLONGEON.

FROM ancient Maya books and inscriptions we learn that the Mayas at one time formed a great nation, occupying the territory between Tehuantepec and Darien. To-day those Indians, as they are called, live in the peninsula of Yucatan, famous for its ruins; in Guatemala, in Peten, in the Lancandon country, on the banks of the Uzumacinta River, and in the valleys between those mountains where the mysterious "land of war" is supposed to be.

Among all people, civilized and uncivilized, superstition exists, though the former are more careful to conceal their peculiar notions. The Mayas are more superstitious now than they were

Indians blasting Rocks to level a Road.

five hundred years ago, for, added to their own queer notions, they have a vast store of strange fancies imported by the Spanish conquerors. Many of the native ideas are of great antiquity, such as the belief in metempsychosis and metamorphosis. Those people hesitate before killing the most venomous reptile, if found in or near the old palaces and temples left by their ancestors, and now gradually crumbling beneath the dense foliage of tropical forests. Urge them to destroy a viper within or near those deserted halls, and they say: "Ah, no! it belongs to the *Xlab-pak yum*" (lord of the old walls), "whose spirit roams here." Under such circumstances they recoil from inflicting death, much as

they would if told to murder their father or mother—a thing unheard of among them, for they revere and honor their parents above all others. To their elders they show much respect, never presuming to contradict them beyond remarking, if they do not agree with what is said, "So says my elder," implying that but for that they would express an opinion.

When questioned about the old ruined cities, they reply, "The dwarfs built them," and insist that the *pixan*, or souls of those dwarfs, always walk about at night, coming into their houses, though the doors be shut. In the daytime they are supposed to dwell among the ruins. The reputation of the *alux* (dwarfs) is not much better than that enjoyed by the "little people" of Ireland and Scotland, accused of stealing butter, souring milk, and changing pretty babies for ugly little creatures with wrinkled faces. The *alux* are said to disturb tired laborers by shaking their hammocks, lash those who slumber too heavily, throw stones, and whistle. They terrify all who look at them, and steal food;

SCHOOL OF MESTIZAS GIRLS AT HOCTAM.

for, though not taller than a child four years old, they can eat more than any man does. Their only article of apparel is a very wide brimmed straw hat.

Belief in these dwarfish apparitions is perhaps induced by a vague knowledge that several centuries ago a race of remarkably small people did live in those parts. Edifices built by them are found on the east coast of Yucatan and on adjacent islands. There are several temples only nine feet high, and triumphal arches of

the same height, while the doorways are but three feet high and eighteen inches wide. In some of those houses domestic utensils have been found, very small. Any traveler may examine the strange little houses; and doubtless the belief in the phantom

SOUTHEAST CORNER OF NORTH WING OF CAN'S PALACE, UXMAL.

alux is an outgrowth of tradition concerning the dwarfish people who constructed them.

Directly opposed to the *alux* is *Huahuapach*, a gigantic specter supposed to put himself in the way of belated travelers and make them fall so as to injure themselves. This, again, would be some dim recollection of those big men whose bones have at various times been unearthed in different parts of the peninsula. Several historians testify to such gigantic remains having been dug from the ground in the early part of the Conquest. We have also been assured by people of Spanish descent, now living in that country, that they themselves have disinterred enormous skulls and other bones of the human body. None had the curiosity to keep them. To this may be added that on the walls of certain ancient structures there are imprints, eleven inches long, of hands that had been dipped in red liquid and pressed upon the stones, as it was customary for the owner of the building to do.

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Xtabai is a wicked, deceitful phantom, said to haunt the highways at night. It appears as a beautiful woman, always combing her luxuriant locks with a plant that the natives call "the comb of *Xtabai*." This lovely being generally runs away when any one approaches, but, if a lovesick laddie does succeed in clasping her in his arms, she instantly transforms herself into a sack of thorns that rests on two duck's feet. After embracing this prickly arrangement the deluded youth is ill with fever.

Another much-dreaded nocturnal, unsubstantial individual is *Balam*, god of agriculture, an old fellow with a long beard, said to walk in the air and whistle as he goes. Should his people fail to make offerings to him, he would vent his spleen by afflicting them with sickness; therefore, the first fruits of the field are for him. The corn first ripe is scattered upon the ground, and pies, the crust made of corn, are also prepared for the god to enjoy at his leisure. These pies are seasoned with enough red pepper to torment the palate of any number of balams (leopards). One pie is put in each corner of the field, three being sprinkled with a liquor called *balché*. The fourth is left without this sauce, possibly for the benefit of any teetotaler friend who may happen to call.

Balché is a liquor made by soaking the bark of a tree thus named in a mixture of honey and water. When fermented and kept some time it is very intoxicating. The Indians use it in all their ancient rites and ceremonies, and the Fans of equatorial Africa make liquor in the same way.

Catholics in name, the Mayas in fact prefer to render homage to any stone figure that once ornamented the temples of their forefathers. We have seen one, kept in a cavern underground, that served as a personification of Balam, for it represented a man with a long beard, and to it they make offerings of corn. As a work of art the figure is worthy of notice. Its antiquity can not be doubted, similar ones being sculptured on pillars at the entrance of a very ancient castle in the famous ruined city of Chichen. The figure in the cavern is on its knees; its hands are raised to a level with the head, palms upturned. On its back is a bag containing a cake of corn and beans, the whole cut from one block of stone. This statue is now black, owing to the incense and candles with which its devotees smoke it. Previous to sowing grain they place before it a basin of cool beverage made of corn, also lighted wax candles and sweet-smelling copal, imploring the god to grant them an abundant harvest. When the crops ripen the finest ears are carried to the smoke-begrimed divinity by men, women, and children, who within the cavern dance and pray all day long, some of their quaint instruments serving as accompaniment to the Christian litanies which they chant without having the vaguest idea of their meaning.

An instrument that they use in their religious practices is the *tunkul*. The literal meaning of this word is "to be worshiping." The tunkul is a piece of wood three feet long and one in diameter, hollowed out. On one side it has a mouth extending nearly from end to end; on the other are two oblong tongues starting from the extremities and separated in the middle only by the thickness of a carpenter's saw. Its mouth is placed in contact with the ground, and the tongues, serving as two keys, are struck with sticks whose ends are covered with India rubber, which makes them rebound. The tones thus produced can be heard five or six miles off, when the wind is favorable, and sound like a great rumbling in the earth. The same instrument was used in Mexico.

A WELL BY THE WAYSIDE.

In the museum of the capital of that republic some finely sculptured tunkuls are preserved.

The Maya Indians take a great deal of pleasure in ceremonies and religious observances; religion is a very important matter with them, though it is doubtful if they could tell exactly what they believe. They punctually attend church, but their worship is in reality an odd mixture of paganism and Christianity. Being fond of sweet things, and by nature indolent, their idea of heaven is a place where they will rest beneath the spreading branches of an evergreen tree and enjoy an inexhaustible supply of sweet things; while hell is a region where they will suffer intensely from cold, fatigue, and hunger. Nor do they hope to escape that

torment, for it is their belief that when death claims them they will be conducted to the gloomy abode to suffer for all the wrong they have done, after which they will be in heaven for a time as a recompense for their good deeds; that then—some ages having elapsed—they must be reborn on this earth, without any recollection of the past or knowledge of the future.

When one is dangerously ill, his relations make offerings to the *yumcimil*, or "god of death." This offering consists of food

A Tunkul.

and drink, which they hang outside of the house. They call it *kex*, or "exchange," because they offer it as a ransom for the life of the patient.

From remote times they have been accustomed to make offerings to the souls of the departed, particularly a certain pie that they call "food for the soul." The crust must be of yellow corn; the interior, tender chicken and small pieces of pork. These pies are wrapped in leaves of the banana tree and baked underground between hot stones. When done, they are placed on the graves or hung from trees close by. Sometimes, after leaving them there for an hour or two, the living take home the pies and enjoy them,

saying that the souls have already drawn from them all the ethereal part of the substance.

When among the ruins in the ancient city of Chichen Itza, we happened to be very hard pressed for food on All Saints day, as on many other occasions, and knowing that the "feast of the dead" would be celebrated in a not very distant village, we allowed some of our men to go there and take their chance of enjoying a good meal.

In that they were most successful, the natives being at all times exceedingly hospitable, and never failing to invite those who approach their home to partake of what they have. But the men also thought of us. We had early taken to our hammocks, remembering the saying, "*Qui dort, dîne*" (He who sleeps, eats). About two o'clock in the morning we were aroused by a man only just returned from the village. He had waited there till all were asleep, then made his way to the graveyard, and gathered from a tree a fine fruit in the shape of a large pie. This he brought to us, wisely arguing that the embodied needed it more than the disembodied. The dead man's food was still wrapped in its banana leaf, and we were not sorry to avail ourselves of this chance to breakfast at two o'clock in the morning. No tender chicken was concealed within that particular crust, only a pig's foot with a few stray bristles on it, and a most liberal dose of red pepper, but hunger made it excellent.

When overtaken by disease, the Indians doctor themselves with certain herbs, and if that fails, call a medicine man, who knows about as much of their malady as they themselves do—perhaps less. They never attribute illness to natural causes, but either declare that they are bewitched or that their time has come and Death wants them. The medicine man pretends that he can discover the party who has done the bewitching, and for that purpose demands three days' meditation in the home of the patient, during which time he must be supplied with all the good food and drink procurable. On the third day he drinks balché, nectar of the gods, until he falls into a heavy sleep. The instant he awakes he looks into a crystal and there pretends to see the witch or wizard. He then scrapes the mud floor under the hammock of the patient, and produces a small figure that he, of course, had concealed about his person, and declares that that was what caused the sickness. For this simple trick he receives a fee. If the patient recovers, the medicine man's reputation is greatly increased. If death results, the mourners say: "It is very hard, but so it was written; his time had come; it had to be thus."

The little figures used by the trickster are made of wax and have a thorn stuck in the part corresponding to the seat of greatest pain in the body of the victim. This particular superstition

may therefore have been introduced by the Spaniards, for at one time *l'envoûtement* was believed in nearly all over Europe; even yet credence is given to it among voodoo societies in Louisiana. *L'envoûtement* consists in pricking and slowly melting a small wax figure representing the individual intended for a victim of magic art. Charles IX, of France, was said to have come to his

INDIAN WOMEN SPINNING.

death by means of wax figures made to his likeness and cursed by magic art which his enemies, the Protestant sorcerers, caused to melt, a little every day, thus extinguishing the life of the king by degrees as the figures were consumed.

That same monarch is said to have expelled thirty thousand sorcerers from the city of Paris; and during the reign of Henry III, France was supposed to be infested with one hundred thousand individuals who practiced the black art. Physicians in those days made the sorcerers responsible for all diseases that they failed to cure. Consumptives especially were supposed to waste away as the wax figures did when melted.

In former times the Indians used to abandon a house after one died in it, because they buried the body either in the house or at the back of it, and were very much afraid of seeing the ghost of the dear departed. Strange creatures, to weep so much at losing them, and then be terrified at the thought of their returning!

They believed that the lower animals also had souls, for they used to put with the corpse of their relations certain provisions

which they said was to feed the souls of the animals they had eaten during life, so that these might not harm them.

They bred a species of dog, quite hairless, called *tzom*, considered a great delicacy. They killed them by choking them in a pit, and this seems to have weighed heavily on their conscience, for they were particularly careful to provide deceased relations with food to pacify the slaughtered *tzoms*.

Being constant and careful observers of Nature, and seeing the remarkable works of many creatures, they attribute intelligence to small insects, such as the ants and bees. In some parts of England it is supposed that bees will not remain on the premises after there is a death in the house of their owner, unless an intimation of the fact be conveyed to them. Therefore some go and tell the bees; others tie a piece of crape to a stick, and set it in front of the hives.

The Indians in question would not tie crape near their hives, for they themselves never use any kind of mourning, retaining always their white garments. They suspend from the hives gourds filled with a beverage made from corn, in order that the bees may not go away, but produce abundant honey and keep sickness from the home. The hives are not like those in use among us, but simply pieces of trunk hollowed out, wooden walls being fitted into the ends and covered with mud so that the name

A Yucatan Village.

of the owner may be stamped on it with white ashes. A small hole is left in the middle of each end for the passage of the bees. If the hives are not cleaned from time to time, the bees desert them. In order to do this, the operator removes the end walls, cleans the interior thoroughly, and rubs it with a little honey and an aromatic plant that is much liked by the bees. Unlike our bees, these are quite harmless, black and small, though they mani-

fest their annoyance when intruded upon, by swarming about ones head, getting into hair, ears, eyes, and nose. After their hives are cleaned they make no mistake as to their homes, every insect returning with unerring precision to its own quarters. At each entrance a bee sentinel constantly stands, to give warning of approaching danger, when, from within, the door is immediately blockaded.

We must not forget to mention the *Ez*, the genuine wizard, supposed to call to his aid the black art for evil purposes, whereas the medicine man is believed to be a good magician. The *Ez* may and does "bewitch" those who offend him, but the medicine man can break the spell. They are very careful to make this distinction between magician and sorcerer.

While in the eastern part of Yucatan, we frequently heard people speak of the Jew's Book, a medical work bearing that title. At last it fell into our hands—not a printed copy, though it has been put in type, but the old Spanish manuscript. The contents rather astonished us. As a cure for leprosy, patients are advised to drink the water in which an unplucked turkey buzzard has been boiled for three hours!

However, we found some very important recipes. Here, for instance, is one to cure the bewitched: "First take a root of vervain, cook it in wine and make the patient drink it. This will be thrown up. To know if the person is bewitched, pass over him a branch of the plant called *skunk*. If the leaves turn purple, the patient is bewitched. To free him from the enchantment, let him wear a cross made from the root of the skunk plant." The odor of that plant would most undoubtedly remove all charm from any person!

Side by side with those absurd prescriptions, there are others quite in accordance with the *materia medica*. The book is believed to have been written by a white man, and many white people and half-breeds have the greatest confidence in it. As for the Indians, they summon the medicine man to give them herbs and dispel the evil power of the wizard that has prostrated them.

THE work in chemistry of 1893 is described by Prof. J. E. Reynolds as having been substantial in character, though almost unmarked by discoveries of popular interest. Among its features are Moissan's artificial production of the diamond; the studies of Dr. Perkins on electro-magnetic rotation, of Lord Rayleigh on the relative densities of gases, of Dewar on chemical resistance at extremely low temperatures, and of Clowes on exact measurements of flame-cap indications. Horace Brown and Morris, studying the physiology of leaves, have led to novel conclusions respecting the formation of cane sugar and of starch; and Cross, Bevan, and Beadle have added to our knowledge of members of the group of celluloses.

BIOLOGY AND ETHICS.*

By Sir JAMES CRICHTON BROWNE, M. D., F. R. S.

IN the case of civilized man natural selection is subject to numerous and extensive limitations. The struggle for existence still goes on vehemently enough; but it is changed in character, and instead of animal rapine we have industrial competition. The brutal and relentless acts of self-assertion that in a savage state secured the survival of the fittest—that is to say, of those best adapted to savage surroundings—have been condemned as unsuitable to a more artificial existence and are punished as crimes, and the conflict is carried on by cunning devices which abolish the weakest slowly and unobtrusively and do not outrage certain moral feelings opposed to violence which have in the meantime grown up. But, more than that, in social progress the struggle for existence becomes in certain directions a surrender not of the feeblest but of the strongest and the best. A recognition of the obligations which man owes to his fellow-men and the promptings of "Love's divine self-abnegation" impose restraints on some of the competitors who, instead of forcing their way to the front, as they are well able to do, stand aside and allow themselves to be beaten by those less fitted to survive. To adapt the illustrations of Malthus, Nature still spreads her feast for twenty guests, while thirty stand by ready to partake of it, but, whereas in primitive times the twenty strongest would have unhesitatingly appropriated the sustenance, in these more virtuous days fifteen of the strongest and five of the weakest secure it, because five of the strongest have chosen to abrogate their natural claims. The census returns clearly show that while the age of marriage in this country steadily rises among the educated and affluent classes, it remains painfully low in agricultural districts and in the poorer quarters of the great towns.

The interference with the struggle for existence which civilization and ethical development involve is familiar to medical men above all others, for their professional career is one sustained endeavor to prevent the extermination of the unfittest and, therefore, to check the operation of natural selection. It is theirs to succor the victims who have been smitten in the fight, and who, but for their aid, would perish; it is theirs to preserve weakly lives which left unprotected would be ruthlessly stamped out; it is theirs to circumvent conquering bacteria and so prevent mortality and swell the millions contending for a bare sub-

* From an address delivered at the opening of the session of the Sheffield School of Medicine at Firth College, Sheffield, on October 2, 1893, and printed in the London Lancet.

sistence; it is theirs, as the chosen ministers of the higher ethics, on the one hand, to counteract the life-destroying checks which operate chiefly on the feeble and incompetent, and, on the other, to inculcate the prudential considerations which are most influential with the finest types of mankind. No doubt the wider scope which modern science has given to medical practice enables those who pursue it to render services to the strong as well as to the weak, and to compensate in some degree for the general lowering of vitality which the maintenance of sickly lives tends to produce. Sanitary improvements and the removal of many of the causes of disease not only keep the infirm alive but insure increased vigor to the constitutions of the robust. But still the result of medical work as a whole at the present time must tend toward the intensification and the thwarting of the struggle for existence and perhaps to some deterioration of the species, for medical work does intermeddle with Nature's rough and ready methods in selecting her breeders. Great numbers of weakly infants who would formerly have perished in their infancy are now reared to a weakly maturity and enabled to propagate their weakliness (for the weakly are often highly prolific), while they take part in the life battle on terms sometimes made unduly favorable to them by the commiseration that their weakliness commands; and this fact ought not to be lost sight of when we are congratulating ourselves on our greatly diminished death-rate. An enormous saving of life has been effected, but mainly in life's earlier decades. The death-rate is actually increasing among males at all ages above thirty-five and among females at all ages above forty-five; and it is not difficult to prove that this increased mortality at post-meridian ages is due partly to the enhanced wear and tear of modern existence and partly to the survival of weakly lives artificially protected and prolonged.

The origin of those moral sentiments which, in the case of our race, are modifying the course of natural selection and which have evoked and molded the profession to which we belong is as inscrutable as the invention of natural selection itself, but their development has some light thrown on certain of its stages by biological considerations. In the life history of living organisms we can trace out some rudimentary phases of a new struggle for existence, a struggle between ethical principles and animal propensities, a struggle that has to be fought out in the brain and mind of man, but that is foreshadowed in paltry protoplasmic particles. For very early in organization may ethical rudiments be detected; indeed, the moment we get beyond the solitary cell, a simple organism which merely feeds and grows and liberates superfluous parts of its substance to start new organisms like itself, mutual obligation or what might be called a moral relation

is discernible; antagonism is converted into co-operation and conflict gives place to harmony, and the higher we ascend in the scale of being the more far-reaching and complicated does co-operation become. Individualism is gradually subordinated to collectivism, and the struggle for existence becomes mainly the concern of the organism as a whole and is only in a minor degree that of the units of which it is composed. Growth, form, and structure are regulated by an organic process only very slightly modified by external conditions and not at all by the selection of the fittest among the growing, formative, and tissue-making parts. "In each of these complicated structures," says Huxley, in referring to the roots, stems, leaves, flowers, and fruit of a bean, "as in their smallest constituents, there is an immanent energy which in harmony with that resident in all the others incessantly works toward the maintenance of the whole and the efficient performance of the part it has to play in the economy of Nature." In a higher animal we have untold millions of cells of widely different constitution and habits, not merely dwelling together in amity but co-operating for the good of the system in which they are incorporated and undergoing harmonious and efficacious metamorphoses as it unfolds. The system is still engaged in the struggle for existence, but its constituents can not in any true sense be said to be so on their own account. Their self-assertion is limited by the organic process, or what would at one time have been called the law of design, the equilibrium and comity of tissues being secured by a self-restraint that is inherent in them, that was inherent in the vital impulse that called them into being, a restraint on the nutrition and reproduction of each to secure the nutrition and reproduction of all, a restraint that when from any cause it is broken down leads to disease, as in the overgrowth of cancer. And, as in the case of the cell, so in that of the animal, the moment we get beyond the solitary animal fighting for its own life, mutual obligation or consensus becomes apparent, for if two animals combine to fight together there must be a tacit understanding that they are to forbear from fighting each other while so engaged. In all associations of animals the association which is useful to them in their struggle for existence is only maintained by some curtailment of the self-assertion that is of the very essence of the struggle. Sheer animalism is to some extent restained, antagonism for certain purposes is merged in co-operation, and individualism is modified in its manifestations by self-denial. In the ant-hill and beehive and among all state-forming insects may be observed an orderly polity involving the co-operation of different classes which exist not for their own advantage but because they are of value to the state and have given it a superiority over differently constituted colonies, and in

all packs, herds, and communities of animals there is some subordination of self-will to secure the realization of the universal will in social existence. And the higher we ascend in the scale of gregariousness the more conspicuous does co-operation become, until among the higher races of civilized man we find that it has in some degree transferred the pressure of the struggle for existence from the individual to the body corporate, and that it tends to do so more and more. Social organization is loose and shadowy when compared with that of living beings, and differentiation of structure and function in it are partial and ill-defined, but still it is readily perceived that its development is regulated by a social process which, although it may seem to emerge from environment and the struggle for life, clearly implies as it goes on not only the harmonious coexistence of different classes differently employed and interested in a larger life than their own, that of the system or nation of which they form a part, but the subjection of individual self-assertion to social growth, in accordance with some social ideal or, shall we say, design. In the social not less than in the organic process we see pause given to the life struggle and the co-operation of diverse parts to a common end. In highly civilized societies certain classes—propertied and pensioned classes—are practically relieved from the struggle for existence by the operation of moral restraints, and it is the avowed aim of state socialism to make that struggle less and less the concern of the individual and more and more that of the state. In the intercourse between nation and nation traces of co-operation may be recognized.

But it is in sexual relations far more than in the organic or social process that the embryonic forms and cotyledons of the moral sentiments that among mankind, when in full leaf and blossom, mask and overshadow and sometimes choke natural selection may be most clearly recognized. Nutrition is everywhere egotistic, but reproduction is invariably altruistic in its character. In its lowest form, where two exhausted cells flow together, reproduction corresponds with what has been designated protoplasmic hunger; but wherever true sexual union takes place we have activities that are other, regarding and whenever genuine maternity is differentiated we have hints of self-sacrifice. Sexual preferences and the selection of mates have obvious reference to the continuance of the species and the welfare of the offspring and imply co-operation, and the fatality that attends the triumph of motherhood represents the immolation of the individual for the collective advantage. Among the insects we have the pairing of mates preceded by courtship and followed by associated industry, as in the *aterechus*, where the male and female beetle disinterestedly toil together in rolling up receptacles for their unborn off-

spring, and throughout the whole animal kingdom, from the *mesozoa*, where the female dies in giving birth to her ova, upward, we have illustrations of the sacrificial nature of the reproductive process. Rooted in physical wants and sensation, the reproductive impulse and parental instincts are gradually reenforced by psychical sympathies and branch into altruistic manifestations. The fierce fight of the stickleback with his rivals and his jealous guardianship of the nest to which he has conducted his bride may be but expressions of blind instinct, and the brooding of the hen on her eggs may be a mere indulgence in an agreeable siesta, but it is impossible to doubt that in the action of the walrus or tiger in desperately defending its young, even when wounded and suffering, and at the expense of its own life, there is an element of disinterested love. Such maternal devotion evinces not reckless self-assertion and the desire to hunt down competitors, but the antithesis of these: self-abandonment and care for others. Between the mother and her offspring there is no struggle for existence, but there are alliance, affection, and co-operation.

In the pairing of mates, then, in their copartnership often extending far beyond the breeding season, in the provision made for offspring, in the care and training bestowed on them after birth, and in the establishment of family groups, all reproductive phenomena, we have in the animal series the analogues, minute but distinctive, of the altruistic emotions which in human beings, fostered and transmuted by various agencies, have enabled them as regards certain relationships to struggle out of the dismal swamp of the "struggle for existence." And in the case of human beings it has, I believe, been the formation of distinct family groups that has more than any other reproductive influence been contributory to moral progress. The family is the social unit, the nursery of goodness, the school of character, the germ-plasm of the loftiest virtues, for it is by a diffusion of the feelings that well up within its precincts to the clan, the nation, and the race that we become public-spirited, patriotic, and philanthropic. The savage owes to it his first glimmerings of ethics, and we in this country owe to it the prosperity we enjoy. Its associated life necessitates a curtailment of self-assertion, a discipline of self-will, and is incompatible with irresponsible atomism, but favors the evolution in due sequence of the dispositions that fit for companionship under civilized conditions.

Now we have been told lately that the family is played out and doomed. Mr. Pearson, in his remarkable and able work, has argued that it will ultimately, to a great extent, be merged in the nation. He looks forward to a state of things in which there will be a weakening of the marriage bond, wedlock being, instead of a union for life, a partnership during good behavior or pleasure,

and in which children growing up, better educated than father or mother, will know that they have to thank the state for schooling and protection and are little indebted to their parents, who have simply taken advantage of their tender years to confiscate the proceeds of their industry. In these halcyon days there will be a state *crèche*, a state school and state medical institution, supplemented by state meals, and the child when well drilled in the state gymnasium will pass from the state school into a state workshop, and finally on to the state crematorium. The result of all this will be that as marriage becomes legalized concubinage the obligation of family duties will attenuate; as children understand that it is to the state they have been indebted for maintenance the old feelings of gratitude and affection which bound them to their parents will dwindle away; and as parents lose their proprietary and administrative rights over children they will more and more shift the responsibility for them on to the state. The family with all its sacred traditions and precious training will decline, and man—like the cuckoo—will be constantly seeking to foist on others the maintenance of his offspring. Mr. Pearson's prognostications, however, are, I venture to think, of an unnecessarily gloomy description. They are founded on the assumption that society is destined to become more and more secular; they betray ignorance of human nature, for surely the love of children for parents is not founded solely on a sordid calculation of what they owe them; and they involve the error that the volume of feeling must always be the same and that its expansion in one direction, so as to embrace the sphere of state action, implies its contraction in another direction, so as to exclude family ties and claims. But there is no reason to doubt that reverence for the state may grow without supplanting reverence for the family; nay, there is reason to hope that parental and filial affection will become stronger and more tenacious as time goes on. The restrictions placed by the state, as the exponent of enlightened opinion and sentiment, on the autocratic powers which the head of the family at one time possessed—the very existence of which provoked antagonism and the arbitrary exercise of which corrupted—may be expected to soften and cement the family relationship and make it more complete and lasting than it has hitherto been. Then it is to be remembered that the period of dependence of offspring on parents steadily increases as evolution advances. The higher the animal the longer the duration of this period of dependence. It is more protracted in civilized than in savage races and now than it has been heretofore. And this protraction of intimate intercourse and reciprocal relations between the members of a family certainly means a deepening of the sense of kinship. We may flatter ourselves

with the hope, then, that the tender and, indeed, sacred feelings which have been nurtured in household association will retain their dominion over us, and that the family will survive in unimpaired integrity, the fountain head of altruistic emotions, the palladium of sound morality.

THE ACTION OF MASSAGE UPON THE MUSCLES.

By DOUGLAS GRAHAM, M. D.

THAT "science follows art with limping strides," as so well expressed by an able physician, is perhaps nowhere oftener seen than in the various branches of the practice of medicine. Experience has taught us from time immemorial the value of massage as a nerve and muscle tonic, and, like all good things, the possibility of its overuse. But the recent experiments of Prof. Arnaldo Maggiora, of the University of Turin, so clearly and beautifully detailed in the *Archives Italiennes de Biologie* (tome xii, page 225), have demonstrated that this matter can be brought into the sunny light of exact science and away from the somber shades of quackery, where it has been so long relegated by the vast majority of the medical profession. Zabludowski, it is true, had in part prepared the way for this by showing that when after fatigue from a definite amount of work a rest of fifteen minutes was insufficient to restore the tired muscles to their former vigor, after massage for five minutes they were capable of doing as much work as before, and after massage for fifteen minutes they could do twice as much work as at first.

Prof. Maggiora endeavored to ascertain:

1. The action of massage upon muscles in a state of repose. For this purpose the fatigue curves of the right and left middle fingers in maximum voluntary flexion every two seconds with a weight of three kilogrammes (6·6 pounds) were taken at 8 and 11 A. M., at 2 and 5 P. M., and the following day the fatigue curves of the same muscles with the same weight and rhythm were taken after mixed massage (friction, percussion, and kneading) for three minutes at the same hours of the day. The average result showed that the muscles did almost twice as much work after massage as they did before. The average of the work without massage was 4·252 kilogrammes for the left middle finger, but after massage of the finger and forearm the average was 8·019 kilogrammes before extreme fatigue stopped further contractions. An analogous series of experiments was next made in which the electrical current was employed to tire the muscles by applying it directly to them, and also to the median nerve. The results without and with massage

were similar to the first series, and showed that it takes much longer to fatigue the muscles by contraction from electrical irritation after massage than before.*

2. The next series of experiments were undertaken with a view to determine whether the beneficial effects of mixed massage (friction, percussion, and kneading) increased in proportion to the duration of its application. At 8 A. M. the normal fatigue curve was taken, then every two hours and a quarter after this the curve was taken, having been preceded by two, five, ten, and fifteen minutes of massage of the right and left middle fingers and their corresponding muscles in the forearm. Ten fatigue tracings were thus taken, and the result showed that with five minutes of massage all the useful effect that could be produced was obtained. When the massage was continued longer, for ten or fifteen minutes, there were but slight variations in the amount of work above and below that after five minutes. Similar experiments were made in which electricity was used to tire the muscles in place of voluntary flexion, and the same result was obtained.

3. The object of the next series of experiments was to ascertain the effects of the principal maneuvers of massage—friction, percussion, and *pétrissage*, or kneading. The mode of procedure was as before: first, the normal fatigue tracing was taken; then at regular intervals during the day, every two hours, the fatigue curve was inscribed after five minutes of friction or *effleurage*, after five minutes of percussion, after five minutes of *pétrissage*, and finally after five minutes of friction, percussion, and *pétrissage* alternating. The results showed that there was very little difference in the work that could be accomplished after five minutes of friction as compared with five minutes of percussion. But there was a great increase in the number and strength of the contractions after *pétrissage*. The best effect, however, was obtained after the alternations of all three. (It would be interesting to reproduce the tables and tracings if space allowed.) Like results were obtained when the contractions were produced by electricity applied to the median nerve or to the muscles directly, and the friction, percussion, and *pétrissage* employed separately and alternately.

4. The effects of massage upon muscles weakened from various causes were also studied in the same exact manner by Dr. Maggiora. Upon muscles weakened from fasting the effect of massage was to restore them temporarily, so that they gave normal trac-

* I have elsewhere called attention to the fact that after massage muscles give a much more ready, vigorous, and agreeable response to the will and to the faradic current than they do before.—D. G.

ings of fatigue; and the same result was obtained when the electric current in place of the will was used to tire the muscles.

5. As the result of general fatigue, the muscles of the hand were also tried in an indirect manner. Prof. Maggiora, after a walk of ten miles, to which he was not accustomed, took a tracing of the fatigue curves of the right and left middle fingers as before, and found that they were only capable of doing one fourth as much work as when he was rested. After massage for ten minutes they were so much temporarily rested that they did nearly a normal amount of work and gave nearly a normal tracing. The work probably would have been equal to normal had it not been for the superadded fatigue of taking the fatigue tracing half an hour before the massage; for it has been found that the muscles of the middle finger when tired by contractions with three kilogrammes every two seconds require about two hours' rest in order to give normal fatigue tracings every two hours during the day.

6. The effect of massage upon muscles weakened by loss of sleep was also inspected. In muscular fatigue from fasting rest alone does not restore them, and in fatigue from wakefulness nourishment alone affords no appreciable relief. After the loss of a night's sleep the fatigue curve was taken and found to be very small, but after ten minutes of massage it was temporarily restored to a natural curve, which could not be obtained on previous occasions by rest nor by nerve tonics alone.

7. Intense and prolonged intellectual work produces a state of general lassitude. After the final examination of twenty medical students, which lasted for five hours, Prof. Maggiora was much exhausted. He then took a fatigue curve of flexion of the middle fingers of both hands. This was only about one fifth normal. Half an hour later, after ten minutes of massage, the number of contractions was little less than natural, and might have reached natural but for the fatigue induced by the preceding experiment.

8. After a slight attack of fever of ten hours' duration the muscles were weak the whole of the following day, but after massage the aptitude for work was increased so that the contractions of the fingers gave almost a natural tracing of fatigue.

9. The effect of massage upon anæmic muscles was most interesting. Dr. Maggiora demonstrated that anæmia for a short time—from three to five minutes—produces phenomena in muscles similar to fatigue; or, in other words, lessens their vigor and resistance to work. Compression of his brachial artery was made for three minutes, and at the end of this time, while the compression was still maintained, a fatigue tracing was taken and found to be very small, the finger contracting only eleven times. Two hours later the brachial artery was again compressed for three minutes, and at the same time the forearm was subjected to mas-

sage. At the end of three minutes, the anæmia being kept up, another tracing was taken, and the muscles contracted but nine times, when prevented by fatigue from doing more. Massage has, therefore, no effect upon muscles thus rendered so completely anæmic in the way of increasing their capability for work.

This experiment was made with a weight of one kilogramme (2·2 pounds) and contractions every two seconds. It was found that in a natural condition the middle finger could thus contract two hundred and sixty-five times without any fatigue.*

In comparing this last experiment with the preceding ones it is found that the effect of massage consists essentially in re-awakening the phenomena of the local circulation, in bringing to the muscles a greater quantity of material necessary for their contraction, and in removing the retrograde products of muscular work.

RÉSUMÉ.—1. Massage, when applied upon a muscle in a state of repose, increases its resistance to work and modifies its fatigue curve by retarding the manifestation thereof.

2. The beneficial effect of massage is within certain limits in proportion to the duration of its application. Beyond these limits there is not obtained any further increase in the production of mechanical work.

3. Massage can hinder in muscles the accumulated effects of fatigue proceeding from the effects of work when not sufficient intervals of rest have been allowed.

4. The various manœuvers of massage act with different intensity upon the aptitude of muscles for work. Percussion and friction are inferior to *pétrissage* and to mixed massage.

5. In muscles weakened by fasting we can, by means of massage, notably ameliorate their resistance to work.

6. Upon muscles fatigued or weakened by a cause which acts upon the whole muscular system, such as prolonged walking, loss of sleep, loss of food, excessive intellectual work, etc., massage exerts a restorative influence which brings back to them their power of doing a natural amount of work.

7. The beneficial effects of massage upon the phenomena of muscular work are no longer produced when it is applied upon a muscle in which the circulation of blood has been suppressed.

THE potato, according to Mrs. Lily Grove, grows native in the islands of Chiloe, in the wildest districts, even at the top of the highest mountains. A whole region is called after it, and it is often the sole food of the people.

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* In all these experiments the massage was done with the same energy by Prof. Maggiora's assistant, Dr. Grandis. The ergograph of Prof. Mosso was used to take the tracings of the fatigue curves.

THE ICE AGE AND ITS WORK.

By ALFRED R. WALLACE, F. R. S.

ERRATIC BLOCKS AND ICE-SHEETS.

I.

IT is little more than fifty years ago that one of the most potent agents in modifying the surface features of our country was first recognized. Before 1840, when Agassiz accompanied Buckland to Scotland, the Lake District, and Wales, discovering everywhere the same indications of the former presence of glaciers as are to be found so abundantly in Switzerland, no geologist had conceived the possibility of a recent glacial epoch in the temperate portion of the northern hemisphere. From that year, however, a new science came into existence, and it was recognized that only by a careful study of existing glaciers, of the nature of the work they now do, and of the indications of the work they have done in past ages, could we explain many curious phenomena that had hitherto been vaguely regarded as indications of diluvial agency. One of the first fruits of the new science was the conversion of the author of Reliquiæ Diluvianæ—Dr. Buckland, who, having studied the work of glaciers in Switzerland in company with Agassiz, became convinced that numerous phenomena he had observed in this country could only be due to the very same causes. In November, 1840, he read a paper before the Geological Society on the Evidences of Glaciers in Scotland and the North of England, and from that time to the present the study of glaciers and of their work has been systematically pursued with a large amount of success. One after another crude theories have been abandoned, facts have steadily accumulated, and their logical though cautious interpretation has led to a considerable body of well-supported inductions on which the new science is becoming firmly established. Some of the most important and far-reaching of these inductions are, however, still denied by writers who have a wide acquaintance with modern glaciers; and as several works have recently appeared on both sides of the controversy, the time seems appropriate for a popular sketch of the progress of the glacial theory, together with a more detailed discussion of some of the most disputed points as to which it seems to the present writer that sound reasoning is even more required than the further accumulation of facts.*

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* The works referred to are: Do Glaciers Excavate? by Prof. T. G. Bonney, F. R. S. (The Geographical Journal, vol. i, No. 6); The Glacial Nightmare and the Flood, by Sir H. H. Howorth, M. P., F. R. S.; Fragments of Earth Lore, by Prof. James Geikie, F. R. S.;

In the last century, Swedenborg, Linnæus, Pallas, De Luc, and many other eminent writers took notice of the remarkable fact that in Scandinavia, Russia, Germany, and Switzerland detached rocks or bowlders were found, often in great abundance and of immense size, and of a kind that did not exist *in situ* in the same district, but which were often only to be discovered in remote localities, sometimes hundreds of miles away. Those who ventured to speculate on the origin of these traveled rocks usually had recourse to water power to account for their removal; and as their large size and often elevated position required some unusual force to carry them, there arose the idea of enormous floods sweeping over whole continents; and for a long time this diluvial theory was the only one that appeared to be available, although the difficulties of its application to explain all the phenomena became greater the more closely those phenomena were studied. Still, there was apparently no other known or conceivable means of accounting for them, and for the enormous mounds of gravel or clay intermixed with bowlders which often accompanied them; and the efforts of geologists were therefore directed to the discovery of how the water power had acted, and by what means the supposed floods could have been produced.

There were not wanting men who saw that no action of water alone could account for the facts. Sir James Hall pointed this out with regard to erratics on the Jura, whose source was undoubtedly in the far-distant Alps; and Mr. Grainger, in America, described some of the parallel grooves and flutings running for nearly a mile in Ohio, strongly arguing that no action of running water could have produced them, but that an agent was required the direction of whose movement was fixed and unalterable for long distances and for a great length of time. No light was, however, thrown on the problem till 1822, when Venetz, a Swiss engineer, finding that existing glaciers varied in extent from year to year and that historical records showed them to have considerably increased during the last eight centuries, was further led to observe that long before the historical era the glaciers had been immensely more extensive, as shown by the smooth and rounded rocks, by longitudinal scratches and grooves pointing down the valleys, and by numbers of old moraines exactly similar in form and materials to those deposited by existing glaciers. He read a paper before the Helvetic Society of Natural History, and urged that glaciers once stretched down the Rhone Valley as far as the

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Man and the Glacial Period, by Prof. G. F. Wright, F. G. S. A.; La Période Glaciaire, by A. Falsan; and the Glacialist's Magazine, edited by Percy F. Kendall, F. G. S.; from which works, and from those of Lyell, Ramsay, Geikie, and the American geologists, most of the facts referred to in the present article are derived.

Jura, and there deposited the erratic blocks which had so puzzled the diluvialists to explain.

Other writers soon followed the clew thus given. In 1835 Charpentier, after a close study of the erratic blocks and of their sources, adopted the views of Venetz. Agassiz followed, and by his strenuous advocacy did much to spread correct views as to the former extension of the Alpine glaciers, and their capability of explaining the numerous superficial phenomena which in all northern countries had been thought to afford proofs of enormous floods and of the submergence of a large part of Europe under a deep sea. He has, therefore, gained the reputation of being the originator of the modern school of glacialists, which undoubtedly owes much to his energy, research, and powers of exposition, though all the more important facts, as well as the logical conclusions to be drawn from them, had been pointed out by previous writers.

Before proceeding further, it will be well to give a brief outline of the phenomena which lead to the conclusion that glaciers have formerly existed in districts and countries where even perpetual snow on the mountain tops is now unknown. These may be briefly classed as—1. Moraines and drifts. 2. Rounded, smoothed, or planed rocks. 3. Striæ, grooves, and furrows on rock surfaces. 4. Erratics and perched blocks.

1. Moraines are those heaps or ridges of rock and other *débris* which are deposited on the surface of a glacier from the precipices or mountain slopes which border it, and which form what are termed lateral and medial moraines while upon it, and terminal moraines when, being gradually discharged at its end, either from above or from beneath it, they form great heaps of rock and gravel corresponding in outline and extent to that of the terminal ice-cliff. Such moraines can be seen on and near all existing glaciers, and their mode of formation and characteristics are perfectly well known. If the glacier is continuously retreating, then the terminal moraine will form more or less irregular heaps over the surface the glacier has formerly covered; but when, as is usually the case, the glacier remains stationary for a considerable period, then the terminal moraine will have a definite form, and will often stretch quite across the valley, but presenting one or more openings through which the glacier stream has cut its way. Such moraines form steep mounds, usually curved and often very regular, seeming from a little distance to block up the valley like an artificial earthwork. Among hundreds that might be enumerated, good examples may be seen in Glen Isla (Forfarshire), in the Troutbeck Valley near Windermere, and in Cwm Glas, on the north side of Snowdon, this latter being so regularly curved, evenly sloped, and level-topped as to look from below

exactly like an ancient fortification. The characteristic features of moraines are their position in valleys where there are other indications of glacial action, their steep slopes and often level tops, but especially their composition of earth, stones, and gravel, with large fragments of rock irregularly scattered through them from top to bottom without any sign of stratification, while usually one or more large blocks rest upon their summits in positions where they could only have been left by the retreat of the glacier, or possibly stranded from floating ice. Where extensive glaciers have covered large areas of nearly level ground, the moraines form great sheets extending for many miles, often concealing the original contours of the country, and then receive the general name of drift. The composition of drift is usually the same as that of well-marked moraines, large blocks of stone being distributed throughout its mass. It is this which mainly distinguishes drift from alluvial or shore deposits, in which the materials are always more or less assorted and stratified; but the angular forms of many of the contained blocks and the striated surfaces of others are also characteristic. Besides the terminal moraines of extinct glaciers, lateral moraines are also left along the slopes of open valleys from which glaciers have retreated. As a whole, moraines are well distinguished from all accumulations formed by water, and it has not been shown that any other agency than glaciers is capable of forming them. In all recently glaciated countries they are to be found more or less frequently, and thus afford an excellent first indication of the former existence of glaciers.

2. Smoothed and rounded rocks, called in Switzerland "roches moutonnées," from their supposed resemblance at a distance to sheep lying down, are perhaps the most general of all the indications of glacial action. Every glacier carries with it, imbedded in its under surface, numbers of rocks and stones, which, during the slow but unceasing motion over its bed, crush and grind down all rocky projections, producing in the end gently rounded or almost flat surfaces even on the hardest and toughest rocks. In many of the valleys of Wales, the Lake District, and Scotland every exposed rock has acquired this characteristic outline, and the same feature can be traced on all the rocky slopes, and often on the summits of the lesser heights; and the explanation how these forms have been produced is not a theory only, but has been observed in actual operation in the accessible portions of many glaciers. Rocks and stones are to be seen imbedded in the ice and actually scratching, grooving, and grinding the rock beneath in their slow but irresistible onward motion. The rocky islets in Windermere, Ullswater, and other lakes, as well as the Thousand Islands of the St. Lawrence, are thus ice-ground; and the amount

of the grinding can often be seen to be proportional to the pressure and motion of the advancing glacier. I recently noticed in the marshy alluvial plain above Derwentwater a projecting rock which has been ground down to so regular a curve as to look like a portion of an enormous globe buried in the earth. By rough measurement and estimate this rock was about two hundred and fifty feet across, and twenty or thirty feet high. It was formed of hard slate, with numerous quartzite veins, the whole ground down to a uniform spherical surface. It had evidently once been an island in the lake, having a much broader base now hidden by the alluvium, and may originally have been one of those abrupt craggy rocks a few hundred feet high, which, owing to their superior hardness or tenacity, resisted ordinary denudation, and which, when above the old ice-level, form those numerous "pikes" which add so much to the wild and picturesque scenery of the district. Looking at such rocks as this, with outlines so utterly unlike any that are produced in similar formations by subaërial denudation—and they are to be seen by scores in all glaciated regions—we can not but conclude that the ice tool has done more than merely rub off the angles and minor prominences, and that it has really ground away rocky hills to an unknown but very considerable extent; and this conclusion is, as we shall see, supported by a very large amount of confirmatory evidence. It may be noted that ice-ground rocks usually show the direction in which the ice has moved, by the side opposed to the motion being more completely smoothed than the lee side, which often retains some of its ruggedness, having been protected partly by the ice overriding it and partly by the accumulation of its own *débris*. Where such rocks occur in the higher parts of valleys the smooth side always looks up the valley from which the glacier has descended. In the more open parts of valleys, or in high coombs or cirques, where two or more small ravines meet and where the ice may have been embayed and have acquired a somewhat rotary motion, the rocks are seen to be ground down on all sides into smooth mammillated mounds or hummocks, showing that the ice has been forced into all the irregularities of the surface. An example on a small scale is to be seen in Cwm Glas, on the north side of Snowdon, above the fine moraine already mentioned, and in many other places around the same mountain. On the whole, considering their abundance in all glaciated regions, and the amount of information they give as to the direction and grinding power of ice, these rounded rocks afford one of the most instructive indications of the former presence of glaciers; and we must also agree with the conclusin of Darwin (in a paper written after studying the phenomena of ice-action in North Wales, and while fresh from his observations of glaciers and icebergs in the South-

ern hemisphere) that "one of the best criterions between the effects produced by the passage of glaciers and of icebergs is boss or dome-shaped rocks."

3. Striated, grooved, and fluted rocks, though closely connected with the preceding, form a distinct kind of evidence of the greatest value. Most of the bosses of rock just described have been exposed to the action of the atmosphere, perhaps since the ice left them, and have thus become more or less roughened or even disintegrated; but where the rocks have been protected by a covering of drift, or even of turf, and have been recently exposed, they often exhibit numerous parallel striæ, varying from the finest scratches to deep furrows a foot or more in diameter. Fine examples are to be seen near the lakes of Llanberis, and they occur more or less frequently in every glaciated country. Perhaps none of the effects of ice so clearly demonstrate the action of glaciers as opposed to that of icebergs, owing to the general constancy of the direction of the striæ, and the long distances they may be traced up and down slopes, with a steadiness of motion and evenness of cutting power which no floating mass could possibly exert. Sir A. Geikie tells us that in Gareloch, Bute, and Cantyre the striations on the rocks run up and over the ridges, and are as clearly shown on the hill tops as in the valleys. Mr. D. Mackintosh states (in his paper on the Ice-sheet of the Lake District and of North Wales) that in the valley above Windermere the striæ cross Rydal Fell, Loughrigg Fell, and Orrest Head, ascending and descending their slopes, often obliquely. But it is in the United States that the most remarkable rock-groovings are to be found, extending over a large portion of the northeastern States. In his report on The Rock-scorings of the Great Ice Invasions Mr. T. C. Chamberlin gives many fine illustrations, from photographs, showing striæ and grooves along sloping, curved, or vertical surfaces, the striæ following the changes of curve, so that the grinding material must have been slowly forced into close contact with the irregular surface. Of one of these examples Mr. Chamberlin says:

> The climax of adaptability is reached in the striation of warped and twisted surfaces, and of tortuous valleys. One of the most remarkable known instances of this within the limits of photographic illustration is furnished by the great glacial grooves at Kelly's Island (Fig. 17). These exhibit not only the pliancy of the ice, but at the same time its strong hold upon the armature with which it did its work of abrasion, grooving, and striation. For, while these grooves can scarcely be supposed to have been originated *de novo* by the gouging action of the ice, they are, nevertheless, plowed with deep furrows, the symmetry, continuity, and peculiar form of some of which are only intelligible on the supposition that they were cut by a single graving tool, held with sufficient tenacity by the ice to execute by a single movement a deep, sharply defined groove. There is, perhaps, no finer illustration of the pliancy with which the ice yielded to its encompassing

barriers, the tenacity with which it held its armature, and withal the pressure that both forced it into compliance with its tortuous channel, and pressed it relentlessly forward.*

Kelly's Island is at the western end of Lake Erie, and in the direction of the striæ to the northeast there is no high ground for about four hundred miles. Looking at these facts, I can not give any weight to the opinions of those who, from observations of existing glaciers, declare positively that ice *can not* go up-hill, and can exert *no* grinding power on level ground.

4. Erratic blocks were among the phenomena that first attracted the attention of men of science. Large masses of granite and hard metamorphic rock, which can be traced to Scandinavia, are found scattered over the plains of Denmark, Prussia, and northern Germany, where they rest either on drift or on quite different formations of the Secondary or Tertiary periods. One of these blocks, estimated at fifteen hundred tons weight, lay in a marshy plain near St. Petersburg, and a portion of it was used for the pedestal of the statue of Peter the Great. In parts of North Germany they are so abundant as to hide the surface of the ground, being piled up in irregular masses forming hills of granite bowlders, which are often covered with forests of pine, birch, and juniper. Far south, at Fürstenwalde, southeast of Berlin, there was a huge block of Swedish red granite, from one half of which the gigantic basin was wrought which stands before the New Museum in that city. In Holstein there is a block of granite twenty feet in diameter; and it was noticed by De Luc that the largest blocks were often found at the greatest distance from the parent rock, and that this fact was conclusive against their having been brought to their present position by the action of floods.

It is, however, in Switzerland that we find erratic blocks which furnish us with the most conclusive testimony to the former enormous extension of glaciers; and as these have been examined with the greatest care, and the facts, as well as the main inductions from the facts, are generally admitted by all modern writers, it will be well to consider them somewhat in detail. It will be found that they give us most valuable information both as to the depth and extension of ancient glaciers, and also to the possibilities of motion in extensive ice-sheets.

The most important of these facts relate to the erratic blocks from the higher Alps, which are found on the flanks of the Jura Mountains wholly formed of limestone, on which it is therefore easy to recognize the granites, slates, and old metamorphic rocks of the Alpine chain. These erratic blocks extend along the Jura

* Seventh Annual Report of the United States Geological Survey, p. 179. Arrangements have now been made for the preservation of these remarkable examples of ice-work.

range for a distance of one hundred miles, and up to a height of two thousand and fifteen feet above the Lake of Neufchâtel. The first important point to notice is that this highest elevation is attained at a spot exactly opposite, and in the same direction as, the Rhone Valley, between Martigny and the head of the Lake of Geneva, while north or south of this point they gradually decline in elevation to about five hundred feet above the lake. The blocks at the highest elevation and central point can be traced to the eastern shoulder of Mont Blanc. All those to the southwest come from the left-hand side of the lower Rhone Valley, while those to the northeast are all from the left side of the upper Rhone Valley and its tributaries. Other rocks coming from the right-hand side of the upper Rhone Valley are found on the right hand or Bernese side of the great valley between the Jura and the Bernese Alps.*

Now, this peculiar and definite distribution, which has been worked out with the greatest care by numerous Swiss geologists, is a necessary consequence of well-known laws of glacier motion. The *débris* from the two sides of the main valley form lateral moraines which, however much the glacier may afterward be contracted or spread out, keep their relative position unchanged. Each important tributary glacier brings in other lateral moraines, and thus when the combined glacier ultimately spreads out in a great lowland valley the several moraines will also spread out, while keeping their relative position, and never crossing over to mingle with each other. So soon as this definite position of the erratics was worked out it became evident that the first explanation—of a great submergence during which the lower Swiss valleys were arms of the sea and the Rhone glacier broke off in icebergs which carried the erratics across to the Jura—was altogether untenable, and that the original explanation of Venetz and Charpentier was the true one. Sir Charles Lyell, who had first adopted the iceberg theory, gave it up on examining the country in 1857 and ascertaining that the facts were correctly stated by the Swiss geologists; and there is at the present day no writer of the least importance who denies this. Sir Henry Howorth, who is one of the strongest opponents of what he considers the extreme views of modern glacialists, gives a full summary of the facts as to the old Rhone glacier from Charpentier. He states that between Martigny and St. Maurice the moraine *débris* on each side of the valley shows the glacier to have reached a height of three thousand feet above the river; farther on, where the valley widens over the Lake of Geneva, it sank to

* A map showing the lines of dispersal of these erratics is given in Lyell's Antiquity of Man, p. 344, and is reproduced in my Island Life, p. 111.

two thousand feet, while on the Jura itself it seems to have been again raised to three thousand feet at its highest point;* and he quotes Charpentier's general conclusion:

> It goes without saying that not only all the valleys of the Valais were filled with ice up to a certain height, but that all lower Switzerland in which we find the erratic *débris* of the Rhone Valley must have been covered by the same glacier. Consequently all the country between the Alps and the Jura, and between the environs of Geneva and those of Soleure, has been the bed of a glacier.

And then, after quoting the observations of Agassiz on the same phenomena and of those of North America, he gives his own conclusions in the following words:

> It is plain to those who would look without prejudice that the rounded and mammillated surfaces, the scratched, polished, and grooved rocks, and a great number of the phenomena which accompanied the distribution of the bowlders and the drift, are consistent only with the fact that in the last geological age there was an immense development of glaciers which occupied not only the high ranges of the Alps and the Dovrefelds, but the secondary ranges and lower heights of the continents of Europe and North America. This conclusion seems supported by every form of converging evidence, and is apparently beyond the reach of cavil. So far there is no question at issue.†

We may take it, therefore, that the views of Charpentier, Agassiz, and Sir Charles Lyell as to the extent and thickness of the great Rhone glacier are admitted to be correct, or, at least, not to be exaggerated, by the most strenuous opponents of the extreme glacialists. We may, therefore, use this as a fixed datum in our further investigations, and I think it will be found to lead us irresistibly to conclusions which in other cases these writers declare to be inadmissible.—*Fortnightly Review.*

THE cities and towns visited by the Rev. J. A. Wylie during an excursion to central Manchuria in September and October, 1892, were centers of trade for the surrounding country, many of them having very large distilleries, inn-yards of great extent capable of accommodating hundreds of guests, and oil-works of various kinds; while outside their walls were generally some brick-kilns, brick-works, and lime-kilns. The houses were chiefly built of brick; burned brick was used for the better houses in the town, while unburned brick or mud only was used in the country. In some of the towns the shop-fronts were quite imposing, substantially built, and lavishly decorated. The streets were wide and level. Mr. Wylie visited the region in the dull season, and saw, either in town or country, none of the stir which all these arrangements betoken for the busy season.

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* These figures are almost certainly incorrect, as the upper surface of the glacier must have had a considerable downward slope to produce motion. The recent work of M. Falsan, La Période Glaciaire, gives the thickness as about 3,800 feet at the head of the lake and 3,250 feet at Geneva.

† The Glacial Nightmare and the Flood, p. 208.

THE FOUNDER OF THE FIRST SCIENTIFIC JOURNAL.

By M. JACQUES BOYER.

WHEN recently the statue of Theophrast Renaudot, the founder of French political journalism, was unveiled, the literary and scientific journals were alike full of praises of him and his work; but none of them recollected another pioneer in his field, the modest and profoundly erudite Denis de Sallo, the founder of the Journal des Sçavants, who did for letters and science what Renaudot so successfully accomplished for politics.

Without undertaking a full sketch of the history of the French scientific press, I desire only to show here how new in 1665 was that idea, which seems so simple and natural now, of the creation of a scientific journal; how many impediments were raised against its creator by the commonplace authors whom the new tribunal condemned without appeal; what patience, what erudition, what a prodigious sum of labor were required from its founders to surmount all the obstacles, avoid all the perils they met every day, and give their work a vitality strong enough to permit it, rising repeatedly from its ashes, to perpetuate itself till our time.

Denis de Sallo, Seigneur of la Coudray, was born in Paris in 1626, of an old noble family of Poitou. His lessons in early childhood were not brilliant; but after he entered the courses of rhetoric at the Collége des Grassins he obtained all the prizes of his class; became in the next year a distinguished pupil in philosophy, and having sustained in public remarkable theses in Latin and Greek, gave himself up with ardor to the study of law. His advance was so rapid that he was able in 1652 to succeed his father, Jacques de Sallo, in his office as counselor at the Parliament of Paris. Three years later he married Elizabeth Menardeau, daughter of a counselor in the Grand Chamber, by whom he had one son and four daughters. He died on the 14th of May, 1669, of apoplexy. His death, according to Vigneuil Marville, was caused by the loss of all his fortune in gambling in 1665; but, besides that this story has little probability in view of the character of De Sallo, who was industrious through all his life, it is controverted by a letter of Guy Patin's of the 13th of November, 1665, which proves that at that time De Sallo had no thought of dying, and by the testimony of Père Honoré de Sainte Marie, who agrees with Moréri in placing his death in 1669 and not in 1665.

Having given an outline of the principal events of De Sallo's life, which was otherwise quiet enough, we pass to the study of his character and work. "He read all sorts of books," says Moréri, "with incredible care, and kept secretaries continually employed to write down his reflections and the passages which he

marked, so that by this plan of studying he fitted himself to compose treatises on every kind of subject, as he showed on several occasions."

It was probably the considerable quantity of material that he collected in this way that suggested to him the thought of giving the public those extracts the utility of which he had recognized in his experiences. He associated with himself in the execution of this work, which was colossal for that time, a number of men of science and letters: De Bourzeis, a distinguished theologian; De Gemberville, chaplain, the famous author of La Pucelle; and the Abbé Gaulois, who, according to Fontenelle, seemed "born for that work"; but De Sallo revised all the articles—not very numerous—which his colaborers furnished, and himself wrote the largest number.

The authorization having been obtained, the support of Colbert assured, and the plan and periods of publication fixed, the Journal des Sçavants appeared on Monday, January 3, 1665, in a sheet and a half quarto, under the pen signature of Hedouville;* and it continued to appear every Monday till the 30th of March of the same year, when the authorization was withdrawn. Although its criticisms were always moderate and just, it had made many enemies among men of letters, and among the Jesuits, then all-powerful, "who were not pleased to see a literary and philosophical tribunal that was not set up by them, and who, moreover, detested De Sallo and his friends as Parlementarians and Gallicans suspected of Jansenism; these added their complaints to the cries of wounded self-love. They secured the aid of the papal nuncio, and he obtained a prohibition against De Sallo's continuing the publication." The pretext alleged for this act was a passage in the Journal in which De Sallo criticised a decree of the Inquisitors, "whose delicate ears required so great circumspection."

Colbert, however, still retained a friendship for his client, recompensed him for the suppression of his journal with an office in the treasury, and, realizing the full value of De Sallo's work, commissioned the Abbé Gaulois to continue it. The Journal reappeared on the 4th of January, 1666, and was henceforth illustrated;† but Abbé Gaulois, who held the direction of the

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* The name of one of his servants.

† As a specimen of the illustrations, we mention a superb engraving representing a louse as seen under the microscope; it measures not less than forty or fifty centimetres (year 1666, page 292 of the reprint of 1729). This reprint is a nearly textual reproduction of the original edition, which is now very rare. It is well to remark here that the Journal des Sçavants, like all similar journals of the seventeenth and eighteenth centuries that were successful, was reprinted as the numbers were exhausted; thus in the set that I have consulted at the library of the Arsenal, the year 1665 is of 1733, and the year 1666 of 1729, while the year 1676 was reprinted in 1717. Hence it is almost impossible to find two col-

paper for nine years, published it very irregularly; thus there was only one number in 1670, and none in 1673.

In 1675 the Journal passed into the hands of Abbé La Roque, who exhibited in his work a punctuality worthy of praise, but was far from knowing as much of science as his predecessor; then in 1686 Chancellor Boucherat, who declared himself its protector, intrusted its direction to President Cousin. Finally, in 1701, the Journal was acquired for the state by Chancellor de Pontchartrain, who gave the preparation of the numbers no longer to one man, but to a company of students, consisting of Dupin, Rassicad, Andry, Fontenelle, and Vertot, with Julien Pouchard as director. Thus renewed, supported by Abbé Bignon, nephew of the chancellor, the Journal des Sçavants appeared again on the 2d day of January, 1702, and its history till 1792, when political events compelled its suspension again, offered the single noteworthy feature that its period of publication was changed in 1764, and from a weekly it became a monthly, with supplements every six months.*

Sylvestre de Sacy tried to resuscitate the Journal in 1796; but his attempt was abandoned after the publication of twelve numbers, from the 16th of nivose to the 30th of prairial of the year V. It was re-established September 1, 1816, on the proposition of Barbé Marbois, Keeper of the Seals, and Dambray, chancellor, on a report of the historian Guizot, then general secretary to the Minister of Justice, and has not been suspended since. The presidency of the editorial committee appertained to the Keeper of the Seals from that time till the imperial decree of May 4, 1857, by which it was transferred to the Minister of Public Instruction, under whose auspices the Journal is still published.

Such has been the checkered career of the first French scientific journal—a career that demonstrates, better than any eulogy can, that the work of De Sallo possessed the qualities of merit and utility which make intellectual work fruitful and durable.

The detailed history of the Journal des Sçavants may be found in Hatin, Histoire politique et littéraire de la presse en France, 1859, vol. ii, p. 151, and those following; and in the Mémoire historique sur le Journal des Sçavans, in the table of the Journal, by the Abbé de Claustre, 1764, vol. x, 595 and following pages.—*Translated for The Popular Science Monthly from the Revue Scientifique.*

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lections of the sets exactly alike. If we add to this that the publisher has sometimes intercalated notes in the reprints without indicating that they were not in the original edition, and that some of the series have been counterfeited in Holland, one may have some idea of the difficulty of the investigation and of the lamentable differences of the editions.

* There were also supplementary volumes for each of the years 1707, 1708, and 1709, and in 1773 only the five numbers of the first five months were published.

SKETCH OF JEAN MARTIN CHARCOT.

A GREAT deal has been added to our knowledge of nervous disease by the labors of Charcot; and extensive fields of investigation hitherto untried have been opened by him.

JEAN MARTIN CHARCOT was born in Paris, France, November 29, 1825, and died near Château Chinon, le Morvan, France, whither he had gone on a pleasure trip with a few friends, in August, 1893. He was industrious in his youth, acquitted himself brilliantly in his classical studies, and, when the time came for choosing his profession, hesitated whether to become an artist or a doctor. Against the latter was the expense of preparing for the profession, but, encouraged by the assurances of his father, who preferred that line, he began the study in 1845. He became *chef de clinique* in 1852, and obtained his degree in 1854. Having obtained several prizes, by which attention was drawn to him, he became a hospital physician in 1856, an adjunct professor in the University of Paris in 1860, and was appointed physician at the hospital of La Salpêtrière in 1862. Here he spent the remainder of his active life, and prosecuted the researches which have made his name famous throughout Europe and America. "In order," the Lancet says, "properly to appreciate the ability which he brought to bear upon his work and the enthusiasm which he could inspire it should be remembered that when he began his now well-known *Leçons* at the Salpêtrière the institution was little less than an ill-assorted collection of five thousand women, comprising the aged, the imbecile, the idiotic, the epileptic, and the paralyzed, in which scarcely an attempt had been made to extract from the wealth of material anything more than a narrow individual experience. In a few years it had been transformed into the very Mecca of neurologists, and this it has remained up to the present time." Besides teaching in his clinic at the Salpêtrière, Charcot conducted an external course in pathology at the *École pratique*. He was given the chair of Pathological Anatomy at the Faculty of Medicine in Paris in 1875, and filled it till 1883. Since 1877 he elucidated with a rare clearness of vision a large number of questions relating to diseases of the liver, kidney, and spinal marrow. He enriched physiology by contributing to the celebrated theory of cerebral localizations. All his studies have borne fruit; they touch a multitude of problems of cerebral pathology or of nervous affections, and have been fertile in practical results, especially as concerns locomotor ataxia, medullary perturbations, aphasia, hysteria, and epilepsy. As Dr. G. Daremburg observes in a notice of him, "He brought order and precision into a multitude of questions which were

in utter disorder previous to him." His chief work was his study of nervous diseases. For years his lectures in the Salpêtrière on neurosis, hypnotism, and the different forms of hysteria attracted universal attention. In no official chair had the attempt been hazarded to take up the study of that series of occult phenomena which have excited public curiosity and baffled the sagacity of observers from ancient times. Charcot subjected these strange phenomena to the precise examination of the experimental method. He studied them with keen vision, so as to be able to reproduce them at will, and often revealed the existence of extraordinary facts which had been before regarded as chimerical. Although his conclusions may sometimes transcend the limits of scientific rigor, it is nevertheless true that he cast a new light on a whole region of investigation hitherto concealed in the dark. Besides making new medical discoveries in this line of research, he opened fresh horizons to science, initiated many pupils, and founded a new school, widely known now as the School of the Salpêtrière.

In connection with the Salpêtrière he founded a laboratory, an anatomo-pathological museum, electro-therapeutic wards, and a photographic studio, where he pictured sections of diseased brains and spinal cords, and formed a collection of portraits of neuropathic patients.

In his studies of gout and the maladies arising from it, to which he gave great attention in the early years of his practice, he discovered relations between disorders which had till then been thought independent of one another. He traced certain kinds of deafness, arthritic rheumatism, and kidney disease to gout, and found the origin of that disease in an overwrought liver and a sluggish skin. Pulmonary diseases also engaged his attention. In his lectures on phthisis he held that all caseation is essentially a tuberculous process, and assigned a secondary place to pneumonic phenomena.

Having been born at the time of the reaction in favor of clericalism, which was encouraged by the devotedly Catholic court of Charles X, and intensified the disgust of the freethinking people of Paris, Charcot grew up with a strong tendency toward extreme heterodoxy. He delighted later in life in demolishing the fetiches set up by the priests with which his investigations brought him in contact; and as Mrs. Crawford says, in the London Illustrated News, "humored the irreligious people in power by reducing the Lourdes and other miracles to suggestion. Gambetta, Naquet, Paul Bert, and other political atheists attended his lectures. He produced the phenomena of stigmates on hysterical girls." In like manner he pointed out analogies in other forms and manifestations of hysteria or hypnotism with

various signs and wonders of religious history and tradition. Regarding them all as remarkable hypnotics, the mystics of the past were favorite subjects of contemplation with him. He accumulated the works of the mystical painters, Andrea del Sarto, Deudato Delmont, Matteo Roselli, and Van Breughel, and read the works of the great mystical writers—Thomas à Kempis, Fénelon, Pascal, and St. Francis of Sales. Hysteria had before this time been regarded as peculiarly the disease of women. He found it attendant upon many forms of disorder from which men suffer, detected it in some of their petty weaknesses and vanities, and regarded it as lying at the bottom of the literary peculiarities of some of the most popular French authors.

He was an intense materialist, and in this he and his school were directly opposed to the other school of alienists in France, that of Nancy and the Charité Hospital, who supposed a psychical force behind the phenomena which came under their observation. With this he had a touch of intolerance toward his opponents. At his demonstrations, according to Mrs. Crawford, he "seemed to command every nerve of his patients. There were but two seats in the room where he taught—one for himself and the other for the patient. The students, disciples and laics—which last came in crowds—stood, some taking notes, and others listening with profound attention. He flattered himself that he forced by the mere power of his will the idlers to be attentive. There was nothing he more resented than for persons of rank, whom he thought not competent to understand him, to compliment him. . . . He began to lose his power 'to fascinate' his pupils some time before his death, and noticed it with sorrow. Though he despised the eulogiums of the incompetent, or wanted no conventional praise, he enjoyed feeling that he was celebrated."

Charcot's literary work was considerable. He published a large number of memoirs, articles, and studies on chronic and nervous diseases, rheumatism, and softening of the brain; and his writings are known, appreciated, and sought for in all countries. His lectures have been translated into several languages. The Lancet, in its estimate of his publications, says: "It is rather more than twenty years since the first part appeared of Leçons sur les Maladies du Système Nerveux. Modest and unpretending, with a gray paper cover and no great thickness of letterpress, the publication was somewhat long in attracting general attention among the profession in this country (England); but to those who had the good fortune to open the *brochure*, what a wealth of interest was laid bare! Custom has made us so familiar with M. Charcot's style that it is difficult to describe the charm of a first introduction to his writings. Putting aside for an instant the scientific value of the material, there was something in the writ-

er's graphic power of imparting information which came with extraordinary force, even upon those who had lingered with delight upon the pages of Watson or Trousseau. In Charcot's case it was not merely that we descried an astonishing facility of picturing by the pen, but above and beyond this was the evidence of the influence of a fresh and powerful mind pervading every paragraph. Lesions of the nervous system formerly huddled together and massed under some name which, pretending to describe, had only obscured, began to emerge with a sharp outline and clearly differentiated form. . . . The written works of Charcot naturally fall into two great divisions—those dealing with nervous diseases generally, and those concerned with the more recondite and abstruse phenomena of hysteria and hypnotism. Probably his most notable works are his Lectures on Nervous Diseases and his volume on Cerebral Localization, both of which are accessible to English readers in the Sydenham Society's translations. In these are chronicled the great advances in our knowledge of nervous symptoms and nervous pathology with which Charcot's name will always be associated." A communication published in the Archives de Physiologie in 1868, on the condition known as "Charcot's joint," is also mentioned as one of his most interesting and important contributions.

Charcot's manner is described as having been short, "but in his way he was kind to his incurables," and "he felt remorse for having treated unfortunate patients as if they had no more feeling than subjects for dissection." He "was truth itself, but he wanted imagination, and was for that reason unable to look with any eyes but his own upon effects and their various causes." In private conversation he had none of the impatient vivacity frequently associated with the French manner. "He was anything rather than loquacious. An attentive, respectful, and sympathetic listener, he ever avoided any dogmatic expressions of opinion, even when dealing with subjects upon which his thought and experience had given him more than ordinary qualification for pronouncing judgment. He would listen with interest to a suggestion, conflicting perhaps with some published opinion of his own, and then, lifting his hands and shoulders with a little expressive gesture, would quietly say, 'It may be so.' He was fair and just in his references to the work of others." A resemblance has been remarked in his face and figure to the conventional type of an abbé.

EDITOR'S TABLE.

THE CONDITIONS OF EFFICIENT GOVERNMENT.

WHEN a private employer of labor wants work well done he tries to employ, in the first place, persons who are presumably, and to the best of his judgment, competent to do it well, and then he gives them an opportunity to show what their qualifications really are. He tests their work as they go on in every way possible, and, if he finds it satisfactory, he congratulates himself on the excellent service he is getting and on the prospect of still better results in the future as his workmen, clerks, superintendents, or whatever they may be, acquire greater experience. If any one were to come and suggest to him to inquire into the political opinions of his assistants and to replace any who did not think quite as he did by inexperienced persons whose one certified virtue was that their political complexion was exactly the same as his own, he would conclude that he had struck a lunatic, and would probably inform the gentleman that such was his opinion.

But, turning to the people of the United States, we may say, in the words of the Roman poet, "The story is told of you with a simple change of name." Yet, after all, there is more than a change of name; for we have assumed that the private employer of labor would treat the person who made such a suggestion to him as a lunatic; but not so do the people of this country treat those who make like suggestions to them. Far from it; they have in past times appeared to find such advice good, and have made those who gave it their trusted counselors. They have cut short the official careers of men who had just begun, after a few years' necessary experience, to be fully competent in their several positions, in order that the work might be taken up by incompetent (because inexperienced) men of a different political profession of faith, on the understanding that the latter should remain in office only so long as their party was "on top" or so long as they themselves continued to be meet instruments of party policy. A given official might at a given moment be carrying on important investigations, the various threads of which were gathered in his own hands and head—possibly a post office inspector trying to get on the track of a series of mail robberies, or a customs officer similarly employed as regards frauds on the revenue, or a statistician marshaling an elaborate array of facts by methods which he himself had carefully devised and could alone apply with the best results, or the head of some scientific bureau who, after a battle with disorganization and sloth and the indifference bred of the political system, had conquered the forces of opposition, established order, and prepared the way for a vigorous advance of the important work committed to him—what would it matter?—whatever he was, or whatever he was doing, when the hour came that a stronger than he politically wanted his place, the supposed guardian of the public interests, cabinet minister or President, would order his dismissal, and bring in the new man to throw everything into confusion, or, at the very least, to retard in a more or less serious degree operations that might have been carried on without a break, to the great advantage of the community.

We do not mean to say that changes have never been made for the better. That has been as it chanced; and certainly under our system changes for the better have for the most part been only too possible. Who that has any ac-

quaintance with the public service of the country is not thoroughly familiar with the official in the last year or so of his term, looking forward to removal and too profoundly discouraged to throw any zeal into his work, or to form any plans for putting things around him into better shape? We have seen him and know whereof we speak, nor will it be devised that the type abounds in the country to-day. As to plans for the future, the simple knowledge that his successor in office will want to do things in his own way, and will lack the experience necessary to the appreciation of arrangements based on experience, would alone dispose the retiring official to live a kind of hand-to-mouth existence till his change came.

Even as we write this article we notice by the dispatches from Washington that the excellent appointment made by the last administration of Prof. T. C. Mendenhall to the superintendence of the Coast Survey is in danger of being canceled in the interest of a Democratic aspirant to the office. There does not appear to be any pretense that Prof. Mendenhall is not in all respects suited to the office he fills, or that he has not already rendered very valuable service in it. It is stated, indeed, in journals not unfavorable to the present administration that he has been and is most efficient, and that under his management the survey is doing better work than ever before; and yet the wolves are howling round him, and the impression is gaining ground that the wolves are to be satisfied. Now, if the public would only reflect a little on what this means and what it costs, we think there would be a more serious revolt against the subordination of civil administration to party politics than this country has witnessed yet. We either want good, faithful, and intelligent service or we do not. If we do, then we must also want the means to the desired end; and an important part of the means will be a secure tenure of office for capable and faithful public servants. If we are indifferent as to the service we get, and wish to keep all the more important offices as rewards for partisan service, let us avow it distinctly and cease to be surprised when officeholders show that they understand why they were appointed and make the public interest as secondary in their own calculations as it was in that of those who gave them their positions. Of course, to avow this would be to accept a very low place in the scale of civilized nations, but if we can not screw our public virtue up to any higher pitch, let us at least honestly acknowledge where we stand.

A POSSIBLE REFORM.

THE saying that "all is for the best in the best possible of worlds" is one which does not at every moment come home to us with conviction. It sometimes seems as if many things went unnecessarily awry, as if evil results were being incurred in many quarters through simple carelessness and indifference to the conditions of well-being. It is difficult, for example, to be quite satisfied with the general effects of popular education, or with the fruits which have as yet been reaped from the diffusion of scientific knowledge. If we ask whether the popular press exhibits a higher intellectual stamp than it did twenty or thirty years ago, the answer will not be altogether reassuring. It is within about thirty years that most of the devices now used by the press for taking the strain off the attention of lazy readers have been introduced; and what a development there has been within the same period in the ignoble industry of purveying and tricking out in all the adornments of newspaper rhetoric a kind of news for which the simplest considerations of public interest would prescribe the briefest and driest treatment, it is quite needless to declare.

We have noticed with pleasure lately

two or three articles drawing attention to the great evil which must undoubtedly be wrought by the highly colored and vigorously expressed representations of vice and criminality with which most of our daily papers teem. That such matter is read with avidity by a large class of the population is only too true; and with the average publisher, unfortunately, no other justification is needed for serving it up in unlimited measure and with the most piquant flavorings that his able "young men" can devise. Apart from the elaborate reporting of vicious and criminal actions, the press gives a large portion of its space to personalities of a very trivial character, which in their way exert almost as hurtful an influence as the more sensational matter. Nothing is more directly or fundamentally opposed to anything like nobility of nature than undue occupation of the mind with personal trifles, particularly when it takes the form of a prying curiosity regarding the private affairs of others. Anything more vulgar than the desire so widely manifested to tear aside the veils which persons who, in certain capacities, are obliged to come more or less before the public eye wish very naturally to draw over their private lives, could not well be imagined. Yet papers which in some respects deserve commendation make the very living of their reporters depend on the success they are able to achieve in this terrible business of destroying a lawful privacy, and encouraging the public to gaze with shameless intrusiveness upon scenes and incidents and sentiments with which they have nothing whatever to do, and which ought to be kept as inviolate as a letter in the mails.

The question of responsibility for the evil done to the community in these ways is one that is dismissed too lightly by those on whom it rests. True, within the limits within which most papers confine their operations, there is no civil tribunal that can interfere with them. Still, the question is a haunting one, "Am I or am I not, for a pecuniary consideration, inflicting deliberately and with full knowledge an injury upon society?" Granted that large numbers are craving for a depraved nutriment, is a man justified in meeting such a demand? If so, the thing may be carried further, and, however vicious the indulgence sought, the mere fact that there is a demand will justify him who undertakes to supply it. Yet there are trades from which many publishers whose journals are highly sensational would shrink. It is a question, evidently, as to where the line should be drawn; and it is a great pity that enterprising journalists can not see their way to drawing it a little nearer to sound morals and public duty.

The fact we have to face to-day is that an agency of unlimited range and influence exists for the popularization of evil, for filling the imagination of young and old with everything that is most unprofitable and pernicious from a moral and social point of view—tales of unbridled license, of violence and revenge, of selfishness and fraud. The same journals that contain this noxious stuff may also contain able editorial articles, and other more or less useful reading matter; but how many read the able editorials compared with the number of those who fasten chiefly or exclusively upon the gossip and the crime? Be the proportion or disproportion what it may, can the fact that a portion of the paper consists of good and useful matter furnish any defense for filling the rest of it with poisonous matter? Mr. Henry Wood, in an article in The Arena on The Psychology of Crime, cites very appositely the apostolic injunction, "Whatsoever things are true, honest, just, pure, lovely, and of good report," to "think on these things," and contrasts it with the invitation constantly held out by the press to drench the mind with thoughts of whatever is false, dis-

honest, unjust, disgusting, and of ill report. The contrast is indeed flagrant, and possibly the apostle, if he could be revived and given a week's reading of some very widely circulated daily papers, might be disposed to wonder that a community which openly and systematically violated an ethical precept so authoritative in its very simplicity as that which he had laid down, should still be very jealous for the name and character of Christian. Then, if he were regaled with a course of pink-tinted police literature, and had spread out before him the numerous illustrated purveyors of vileness that may be seen on most news-stands, he would be too profoundly discouraged, we fear, even to think of inditing a stinging epistle to the Church in these lands.

We do not need, however, to resurrect an apostle in order to arrive at a moral judgment on this matter. By every rule, both of psychology and of common sense, a certain kind of journalism is morbific in its tendency. It brings and is known to bring a plague in its train, perverting the thoughts of youth, and relaxing moral sanctions that are none too strong even in old age. The question then is, How long will it be before the better portion of the community rises in revolt against so great and unnecessary an evil? The ever-ready resort of some, when a reform is to be accomplished, is to legislation: that idea we wholly repudiate; legislation can not touch this particular evil. What is required is that intelligent and well-disposed people should discriminate between papers that treat acts of crime or moral disorder with brevity and reserve and those that seek to make capital out of them, bestowing as far as possible their support on the former and withholding it from the latter. This is a very simple remedy, but it would be wonderfully efficacious if tried on a large scale. But no one need wait for others in this matter. It is a thing which concerns the home, and no one should wait to see whether others are going to protect their homes before taking steps to protect his.

One other word before we leave this subject. When we get down to the root of the matter we find that all this morbid interest in what is evil and trivial arises from a lack of individuality. "You have no soul—that makes you weigh so light," says an old dramatist. It is those who have no deep personal interests of their own, no cultivated tastes, no definite opinions, nothing special to fix and characterize them as individuals, who are insatiable for gossip, and whose love for gossip naturally passes into a love for scandal and whatever else is morally miserable. Multiply individuals in the true sense, and scandal-mongering will just proportionately decline, while the scum-gathering which now forms so large a part of what is called "journalistic enterprise" will become a neglected and dishonored art. How large a part the teaching of science might play in the development of individuality we can not now attempt to indicate: we can merely say that here we see a field of infinite promise which has yielded but little as yet, simply because workers of the right stamp have been few.

THE MOON OF ROMANCE.

THE novelists will not leave "the young moon" or "the crescent moon" alone, and three times out of four they contrive to get it into the wrong place. How to explain the conviction which haunts the minds of so many of them, that the crescent moon may be seen almost any fine evening rising gracefully in the east, is altogether beyond us. The point seems to be one for psychologists. Here is a thing that never was seen since the world began; and yet a number of otherwise sane gentlemen are firmly persuaded that it is a regularly recurring natural phenomenon. Surely the philosophy of this hallucination deserves investigation. The last

case that has come under our notice is in a well-written story called A Comedy of Masks, by Ernest Dowson and Arthur Moore. Two friends are sitting out one summer evening, looking over the Thames, and the story goes on: "By this time the young moon had risen, and its cold light shimmered over the misty river." A novelist need not be an astronomer, but he should at least try to draw from Nature, and should not pretend to have seen the young moon rising at the very hour when it was being packed off to bed. Some day, perhaps, a little acquaintance at first hand with the broadest facts of Nature will be thought a requisite for writing a good novel, but the time is not yet. Meantime, if our novelists would try to bear in mind that the young moon, like other young things, goes to bed early—that Nature does not trust it out late at night—they might get into the way of seeing it at the right time and in the right place, and not treat us to "cold shimmers" that are only moonshine in the least favorable sense of the term.

Since the foregoing was put in type our attention has been called to a precisely similar blunder in an article entitled Notes from a Marine Biological Laboratory, written by a man of science and a college professor, and printed in the February number of this magazine.

In the light of what has previously been said, the situation, we must confess, is decidedly awkward, and not at all to the credit of our editorial scrutiny. Yet, while freely admitting that the case is far less excusable than the one cited above, we are still inclined to regard it as an even more emphatic admonition that writers, and particularly writers on scientific subjects, are under obligations to know what they are talking about, and should also be able to subordinate their poetical ambitions to the requirements of truth.

LITERARY NOTICES.

THE RECRUDESCENCE OF LEPROSY, AND ITS CAUSATION. A POPULAR TREATISE. By WILLIAM TEBB. London: Swan, Sonnenschein & Co., 1893. Pp. 20–21 to 412.

IN the first chapter of this polemic against vaccination the author states that leprosy has greatly increased and is still increasing, and he cites as *evidence* reports from various countries that the disease is more or less prevalent. We submit that there is no evidence of the increase of anything, disease or other, unless facts are given regarding the number reported each year for a series of years. What social economist would be recognized that stated the population of a country was increasing because he saw more children in the maternity hospitals? What financier would be regarded as authority that said the country was richer because he had so many thousands of dollars deposited in his bank, though he was ignorant of the amount of deposits of fifty years previous?

Let us cite an example. Leprosy is increasing in the United States because Dr. Blanc reported forty-two cases of leprosy in New Orleans in 1889. We have practical personal knowledge regarding leprosy in Louisiana, and it is a statistical fact that leprosy is less prevalent there to-day than it was one hundred years ago, and, whether the hereditary causation is always known or not, the disease only affects those having creole ancestors. Dr. Allen's and Dr. Morrow's *speculations* regarding the increase of leprosy in this country are worthless, and are not accepted by the leading dermatologists.

No reference is made to the paper of Hansen, the discoverer of the lepra bacillus, who stated that his investigations among Norwegian lepers that had emigrated to the United States showed that the disease had died out among them.

An elaborate account of the increase of leprosy in India is given; and yet since the publication of this volume the Indian Leprosy Commission has made its report, and, while its figures suggest a decrease rather than an increase in the prevalence of the disease, the commission conservatively prefer to say that the leper population has remained stationary. This lack of the critical faculty in the author

is only equaled by his ignorance of the etiology and pathology of disease. Contagion, inoculation, and predisposition have to him a meaning that is alien to that attached thereto by the medical profession.

Our personal experience in Norway and the United States justifies our statement that if the author's reference to other countries is no more accurate than to these two, then, as a work on leprosy, the book is useless.

Its real purpose, however, is to promulgate the theory that the leprosy that exists to-day is perpetuated by vaccination. We can not trespass upon the space of these columns to discuss so unsubstantial a theory. One swallow does not make a summer, nor do one or more cases of leprosy inoculated with supposed vaccine sustain the author's thesis.

GENERAL THOMAS. By HENRY COPPÉE, LL. D. New York: D. Appleton & Co., 1893. Pp. 332. Price, $1.50. (Great Commanders Series.)

THIS volume of the series in no way falls behind the previous issues, either in the intrinsic interest of the man and his career, or in the style of treatment. General Thomas was born on July 31, 1816, in the southeastern portion of Virginia. Little is known of his early life. In his nineteenth year he began the study of law, but shortly afterward was offered a cadet appointment at West Point, which he promptly accepted. He was graduated in 1840, twelfth in his class. Thomas's first commission was that of second lieutenant in the Third Artillery. He joined his regiment on Governor's Island, New York Harbor, but was soon ordered south to take part in the Florida War, where he gained much distinction and slight promotion. After this he served at several of the Southern military posts. He was with General Taylor during the Mexican war, and was brevetted major for brilliant work.

His personal appearance, about 1850, is thus described: "He was cast in a strong and large mold, and had many of the personal traits of Washington, whom in his intellectual and moral character he greatly resembled." In 1851 he was detailed as instructor of artillery and cavalry at West Point, and while serving here was promoted to a captaincy. It was also during his residence here that he married Miss Frances L. Kellogg, of Troy. In 1855, while in California, he was appointed a major. In 1861 he was advanced to a colonelcy after the resignation of A. S. Johnston, Robert E. Lee, and W. J. Hardee, all of whom joined the Confederacy. General Thomas seems never to have wavered in his allegiance to the Union.

He was appointed brigadier general in 1861. He played an important part in the civil war, and his achievements in its various battles form most of the bulk of the book. He has been accused of being too slow and ponderous in his military manœuvres, but the biographer emphatically denies this and says that the foundation for these statements was derived from his great caution and clear-headedness in military matters. After the war he was appointed commander of the Military Division of the Pacific, where he served only a year, his death occurring suddenly in 1870 from apoplexy. This series has a double value for youthful readers, being really history, in the form of biographical story.

CONTINUOUS-CURRENT DYNAMOS AND MOTORS; THEIR THEORY, DESIGN, AND TESTING. By FRANK P. COX, B. S. New York: W. J. Johnston Co. (Limited), 1893. Pp. 271. Price, $2.

THIS is an elementary treatise on continuous-current dynamos and motors, which deals not only with the theories and laws governing their construction and action, but also with the application of these to their construction and running in the shop and power house. The first four chapters treat of the general principles of the machines, and serve as an introduction and preparation for the succeeding portions. Chapter V has to do with the mathematics of the magnetic circuit; and here the author has carefully abstained from using the higher mathematics and has only assumed for his student a knowledge of algebra and elementary geometry. Chapter VI deals with the theory of windings, losses, etc., and Chapter VII of the special features in motor designing. Chapters VIII, IX, and X relate to the practical application of the previously stated laws. In Chapters XI and XII, testing and handling the completed machine occupy the attention. The last two chapters deal with

the steam engine in its relation to electricity. There are four appendices on tests of irons, ampère turn tables, determination of sizes of wire for armatures and field coils, and on the calculation of belting.

TWO GERMAN GIANTS: FREDERICK THE GREAT AND BISMARCK. By JOHN LORD, D. D., LL. D. New York: Fords, Howard & Hulbert, 1894. Pp. 173.

THIS is a brief account of the early years of these statesmen, followed by a consideration, more philosophical than historical, of their careers. Frederick the Great as the founder, and Bismarck as the builder, of the German Empire, are the aspects in which they appear, and while the author greatly admires their wonderful statesmanship and perseverance under the most overwhelming difficulties, he finds them both, and more especially Frederick, wanting in moral perception. He explains this by their absorbing ambition and love of country which led them to adopt that most dangerous of mottoes, that the end justifies the means. A character sketch of Bismarck by Bayard Taylor, written in 1887, is given, and also Bismarck's great speech on the enlargement of the German army in 1888. The book contains portraits of both Frederick and Bismarck.

ELEMENTARY PALEONTOLOGY FOR GEOLOGICAL STUDENTS. By HENRY WOODS, B. A., F. G. S. New York: Macmillan & Co., 1893. Pp. 222.

THIS little book, which gives an elementary account of invertebrate paleontology, is one of a valuable series, the Cambridge Natural Science Manuals, which are edited by A. E. Shipley, M. A. The author has devoted most of his space to the treatment of those groups of fossil animals which are especially useful to the geologist, and but briefly considered those of interest mainly to the zoölogist. The author thus describes his method of treating the subject: "My plan has been to give, in each group, first an account of its general zoölogical features with a full description of the hard parts; secondly, the classification and characters of those genera which are important geologically; and, thirdly, a sketch of the present and past distribution of the group." For the use of those who wish to obtain a more extended knowledge of the subject, there is appended a list of some of the more important and easily accessible works on paleontology.

AMERICAN TYPES OF ANIMAL LIFE. By ST. GEORGE MIVART, F. R. S. Boston: Little, Brown & Co. Illustrated. Pp. 374. Price, $2.

A SERIES of sketches of the various groups of animals which are either peculiar to America or have their most typical representatives here. It is intended to serve as an introduction to zoölogy, more particularly to the vertebrata, and more especially the mammalia. The first animals considered are the monkeys, to which thirty-five pages, containing several pictures, are devoted. The rarer and more striking forms are especially dealt with, and several amusing and instructive anecdotes related. Next comes the opossum, which is of peculiar interest to us, as it is a form of marsupial found only in America. It has been much studied by the zoölogist and geologist, because of its isolation from other marsupials, and is considered an important link in the evidence which connects the South American continent with Australia, as well as one of the many things indicating a close relationship between North America and the Europe of Tertiary times.

The turkey forms the subject of the third essay. He is so peculiarly an American institution, and, so far as we know, always has been, that, aside from his value as an edible, he deserves careful consideration. That this was appreciated so far back as Revolutionary times is shown by the fact that he was proposed as the national symbol by Franklin. The following extract is interesting in relation to the turkey's identification with holiday occasions:

"In 1566 twelve of these birds were presented to the French king Charles IX; and the first record of its appearance at a state banquet was at his wedding four year's later. Soon after that it seems to have become common in England, and already to have found its place as a family dish at Christmas dinners."

The next twenty-five pages are about the bullfrog and his relations. The author speaks of him as follows: "The frog has special claims to our gratitude and commiseration on account of all it has done and

suffered to increase our knowledge. In every physiological laboratory frogs are such ceaseless subjects of experiment that the animal may well be called the 'martyr of science.' What their legs can do without their bodies, what their bodies can do without their heads, what their arms can do without either head or trunk, what is the effect of the removal of their brains, how they can manage without their eyes, what effects result from all kinds of local irritations, from chokings, from poisonings, from mutilations the most varied: these are questions again and again answered practically for the instruction of youth."

The rattlesnake, "the exclusive possession of which will not excite the envy of other geographical regions," is next on the list. The serotine or Carolina bat is the representative of this family selected, because it is the only animal of this kind found in both the Old World and the New. The American bison gives the title to Chapter VII. It is of interest because of probable extinction in the near future. The raccoon, another peculiarly American product, is next selected as an introduction to the carnivores in general.

The sloth, the typical arboreal animal, is given thirty pages. "A marine animal and a quadruped" is studied in the sea lion in Chapter X. Whales and Mermaids is the title of Chapter XI. The last essay, entitled The Other Beasts, describes briefly the lemurs, rodents, and insect-eating animals, and then follows a recapitulation and summary of what has gone before. The book is extremely interesting, not only because of the good selection of individuals for description, but more, perhaps, because of Prof. Mivart's lively style, and his avoidance of anything which might be termed "dry." The book is well printed and nicely illustrated.

DYNAMIC BREATHING AND HARMONIC GYMNASTICS. By GENEVIEVE STEBBINS. New York: Edgar S. Werner. Pp. 155.

THIS work is intended to set forth a peculiar system of combined mental and muscular calisthenics, part of which, at least, though perhaps of therapeutic value, seem unusually difficult. The following, entitled Yoga Breathing, occurs on page 86, and is a good example of the teaching of the book:

"1. Lie relaxed in an easy position. 2. Breathe strongly with vigorous vertical surging motion, with the same rhythm as in Exercise 1, which stretches the whole trunk like an accordion, and let the mind concentrate itself as follows:

"(*a*) Imagine the ingoing and outgoing breath drawn through the feet, as though the legs were hollow; (*b*) divert the same mental idea to the hands and arms; (*c*) to the knees; (*d*) to the elbows; (*e*) now breathe through the knees and elbows together. . . . (*l*) Complete this mental imagery, with breathing through the head and the whole organism in one grand surging influx of dynamic life."

And again, on page 2, under the heading Dynamic Breathing:

"To those, however, whose studies in life have enabled them to penetrate beneath or to rise above the bias of theological dogma on the one hand, and the speculative hypotheses of scientific schools upon the other, there will be no difficulty in reading between the lines of the present controversy between religion and science. . . ."

There are many other equally irrelevant passages in the book; and taken all together we do not see that it is likely to be of much service to the general reader. It contains a portrait of the author.

IDEALE WELTEN IN WORT UND BILD (Ideal Worlds in Description and Picture). AD. BASTIAN. 8vo. Three Parts. Pp. 791. Twenty-two Plates. Emil Felber, Berlin, 1892.

ADOLPHE BASTIAN, the Director of the Royal Ethnographic Museum at Berlin, is a veteran explorer, a wonderful collector, and an interesting writer. As the result of a journey to Farther India in 1890, we have this great work of nearly eight hundred pages—Ideale Welten. The book should particularly interest us, for the learned author has dedicated it to the Bureau of Ethnology in Washington and other ethnological workers throughout the Union, in memory of our celebration of the quadricentennial The work consists of three parts, separately titled and paged—Reisen auf der vorderindischen Halbinsel, Ethnologie und Geschichte, and Kosmogonien und Theogonien. They are a model to every one who would

make a journey productive to science. Few travelers know what things among any people are interesting to science; still fewer know how to get at them. Bastian goes to the heart of things, and although he gives much of general interest he aims particularly to secure knowledge of the philosophy and the religion of these Eastern peoples. Brahmanism and Buddhism are illuminated by his research, but it is particularly Jainism that he discusses. His work is undoubtedly a most important contribution to our knowledge of this curious religion. Twenty-two interesting plates, mostly copies of drawings or paintings made by Asiatics, give the Brahman, Buddhist, and Jainist ideas of heavens, earths, and hells.

DOMESTIC ECONOMY. By I. H. MAYER, M. D. Lancaster, Pa.: Published by the Author. Pp. 283.

THIS is a work on thrift in the household, rather disconnected, but containing much valuable information. It deals not only with the actual outlay, but also with the facts and behavior which determine and modify the necessity for outlay in special directions. Among the subjects discussed are: The Home—its location, both as regards sanitation and ready accessibility; Education; Recreation; Time—its use and misuse; Fuel; Clothing; Pets and Pests; Food; Drink; Mother and Child; Exercise; and Accidents.

OUTLINES OF FORESTRY. By EDWIN J. HOUSTON, A. M. Philadelphia: J. B. Lippincott Co., 1893. Pp. 254. Price, $1.

THE general conclusion seems to be that, unless something in the way of intelligent and ordered action is attempted toward the preservation of our forests, they will soon be things of the past, so far as commercial value is concerned, and that their destruction will profoundly modify the climate of large sections.

This interesting little book bears directly on the important question of the function of forests in determining climate, and the means of preserving and replacing them. It is a question which is of increasing importance in all countries as they advance in population and manufacture, and has been more or less under discussion in this country for some years past. In view of these facts, it becomes desirable that there should be not only concerted action between large landowners and the Government, under the supervision of especially qualified men, but also that each individual farmer shall appreciate the value of his "wood lot," not simply as a "wood pile," but also and even more *as* a "wood lot," as an important factor in determining, in common with those of his neighbors, the climate and fertility of the region, and hence indirectly his own and his neighbors' prosperity. The latter function is the one which this book is intended to fulfill; it is a primer of forestry. The first five chapters give a brief description of plant physiology and soil formation. These are followed by some pages on the forest's enemies and the forces tending to its destruction. Then comes a consideration of the effect of vegetation on rainfall, drainage, climate, and the purity of the atmosphere. These preliminary discussions are followed by a consideration of the methods by which a barren country may be timbered, or a section from which the forests have been removed may be retimbered. An appendix contains lists of trees suitable for replanting in different portions of the United States.

INORGANIC CHEMISTRY FOR BEGINNERS. By Sir HENRY ROSCOE, F. R. S., assisted by JOSEPH LUNT, F. C. S. New York and London: Macmillan & Co. Pp. 241. Price, 75 cents.

IN this little text-book Roscoe has treated the elementary principles of chemistry more fully than in his Elementary Lessons, while he has restricted the descriptions of elements and their compounds to a few typical examples. In the first portion of the book the basal principles of chemistry are taught in eight chapters or lessons, with the aid of carefully described experiments. At the end of each lesson is a summary under the heading "What we have learned," and a set of questions on the lesson. The rest of the volume is devoted to descriptions of selected elements and their compounds. Nonmetallic Inorganic Chemistry would be a more exact title for the book, as no metals are included among the elements described. There are a hundred and eight cuts of apparatus, etc. The chief characteristic of this text-book is that it boldly abandons the idea of covering

the whole ground, which most schoolbook writers cling to, and aims chiefly to impress the principles of the science upon the pupil's mind. Enough descriptive matter is used to illustrate these principles, but not so much as to obscure the main purpose of the book.

BRITISH LOCOMOTIVES; THEIR HISTORY, CONSTRUCTION, AND MODERN DEVELOPMENT. By C. J. BOWEN COOKE. New York: Macmillan & Co. Pp. 381. Illustrated. Price, $3.

THE usual books on this and kindred subjects are either so technical as to be incomprehensible to the general reader, or so popular as to be of no considerable value to any one. Mr. Cooke has attempted to strike a happy medium, and while giving the mechanical construction and action of locomotives, accurately and in detail, he does so in untechnical language, and assists his text with carefully prepared drawings and diagrams. An idea of the scope of the work may be gathered from some of the chapter headings: Early History; Action of the Steam in the Cylinder; Valve Motion; The Boiler; General Details; How an Engine is put together; Classification of Engines; Brakes; Compound Locomotives; Combustion and Consumption of Fuel, and Engine Drivers and their Duties. The book is nicely printed and fully illustrated.

TEXT-BOOK OF ELEMENTARY BIOLOGY. By H. J. CAMPBELL, M. D. New York: Macmillan & Co., 1893. Illustrated. Pp. 284. Price, $1.60.

THIS book belongs to the series of Introductory Science Text-books which this firm is now publishing, and is one of its most important volumes. The subject is one about which students should have something more than vague ideas; and yet, unfortunately, this is about the extent of their ordinary biological knowledge at the time of graduation. Biology lies at the root of human physiology, and this in turn should dictate that self-care and self-preservation upon which all our other actions in life depend. The scheme of the book is, first, a discourse on living as distinguished from non-living matter; followed by an examination into the properties and characteristics of protoplasm. Then the cell in its various forms, followed by a chapter on embryology. The tissues, both animal and vegetable, are next discussed; and finally there are several pages pointing out the differences between plants and animals, which sum up as follows:

"We have thus seen that there is no single attribute of animals which is not shared by some plants; and, on the other hand, there is no plant characteristic which is possessed by plants alone; hence it is necessary to allow that plants and animals are fundamentally identical, and, in fact, are only divisions of a single vital stock." An elementary examination follows of the forms of life usually considered in introductory text-books—the amœba, yeast plant, vorticella, tapeworm, leech, etc.

Dr. Campbell has given us a work well suited to beginners, and hence an important addition to our text-books on the subject. The book is well printed and illustrated.

A REVIEW OF THE SYSTEMS OF ETHICS FOUNDED ON THE THEORY OF EVOLUTION. By C. M. WILLIAMS. New York and London: Macmillan & Co. Pp. 581. Price, $2.60.

WE have in this volume a substantial contribution to the literature of its subject. It consists of two parts, the first being a presentation of the most prominent systems of evolutionary ethics, under the names of their respective propounders, while the second is a general examination of the whole field. The authors whose views are set forth are Darwin, Wallace, Haeckel, Spencer, Fiske, Rolph, Barratt, Stephen, Carneri, Höffding, Gizycki, Alexander, and Ree. Mr. Williams must be a hero-worshiper who sees all wisdom in Darwin, else he would not have lugged in the great biologist's name at the head of this list. He calls Darwin "the first laborer in this line," and says that "a review of evolutional ethics must, therefore, in order to start with the proper origin of the science, begin with Charles Darwin." He gets together ten pages of extracts from Darwin's works, the first four pages of which relate to nothing but instinct and heredity. These are from the Origin of Species, which appeared in 1859, and the essay on Instinct prepared for that work, but not published till after Darwin's death. Then follow quotations from the Descent of Man, some of which do relate to ethics, but the date when

that book appeared (1871) is much too late to be taken as "the proper origin of the science." Quotations from A. R. Wallace beginning in 1871 come next, and are followed by some from Haeckel beginning in 1874. Having thus examined the theories of what our author calls "the great original authorities," he proceeds with "writers who have turned these theories to account and elaborated them." In this second group of writers he places Herbert Spencer first, and says, "In treating of Mr. Spencer's work, it is necessary to begin with a book which made its appearance before the publication of the Origin of Species, namely, Social Statics (1851)." Mr. Williams's designation of Darwin as "the first laborer in this line" needs no further comment. The views of Spencer are then presented as found in his Social Statics (both the 1851 and the recently revised edition), his Collected Essays, The Man *versus* the State, The Principles of Psychology, the several divisions of The Principles of Ethics, and one or two minor writings. By letting Spencer speak for himself in quotations our author secures a nearly correct representation of his ethical theory, but he states that Spencer in the original Social Statics "advocates the nationalization of land," and neglects to say that Spencer has since repeatedly abjured this doctrine, and leaves nothing in the revised edition that can be construed as supporting it. More space is found needful for Spencer, forty-eight pages, than for any other writer represented. John Fiske is taken up next, and the theories of the other authors noticed follow in the order in which they are named above.

The treatise which forms the second part of this work is one in which a wealth of data has been used, and a highly instructive and suggestive result has been attained. The author begins by examining the operation of heredity and variation in evolution, and passes next to a consideration of intelligence and "end." Among the other topics considered are the mutual relations of thought, feeling, and will in evolution, egoism, altruism, and conscience. There is an interesting chapter on The Moral Progress of the Human Species as shown by History, in which the morals of ancient Greece and Rome and mediæval England are shown to have been far below modern standards. In the closing chapter, on attainment of the ideal, the author touches upon a variety of considerations, and ends with some helpful words on the transition from the belief in a personal immortality to the expectation of persisting after death only as an influence upon those remaining in life.

So valuable a book should not have been issued without an index.

ON THE OLD FRONTIER, OR THE LAST RAID OF THE IROQUOIS. By WILLIAM O. STODDARD. Pp. 340. Price, $1.50. New York: D. Appleton & Co.

THIS is a novel dealing with frontier life in Revolutionary times, when most of the fighting men were with Washington in the East, and the frontiers were therefore very weakly garrisoned. It describes the motives and nature of a raid by the Indians on a settlement known as Plum Creek.

The hero is a boy, who was stolen by the Indians when very young and brought up among them. He finally escapes and makes his way to Plum Creek, where he is adopted by the gunsmith of the settlement. He is able, by reason of his Indian training, to render valuable assistance to the settlers during the skirmishes preceding the concentrated attack, and just at the last, when the fort is about to fall into the hands of the Indians, he appears with a detachment of United States troops and saves its inmates, besides giving the death blow to the Indian raids. He then discovers a relative in the commanding officer of the soldiers, and learns that his family, which he had supposed were massacred at the time of his abduction, are alive, and mourning *his* early demise. The characters speak in dialect, and the book is well illustrated.

The story is "a fiction founded on fact."

After an interval of seven years the first volume of the *History of the Theory of Elasticity*, by the late *Isaac Todhunter*, has been followed by the two parts of Volume II (Macmillan, $7.50). The manuscript that Dr. Todhunter left has been edited and completed by Prof. *Karl Pearson*, the physical and technical branches of the subject being wholly the work of the editor, likewise the general history of the subject after the date

at which Dr. Todhunter left it. The present volume covers the period from Saint-Venant to Lord Kelvin. It carries the analysis of individual memoirs completely to the year 1860, but after that point the editor has found it practicable to deal with the work of certain elasticians only. These are the two just named, with Boussinesq, Rankine, F. Neumann, Kirchhoff, and Clebsch. Although the part since 1860 is only the framework of what Prof. Pearson hoped to make it, the work is a monumental one. The number of the memoirs included in the thirteen hundred pages of the second volume by no means measures the work expended upon this part of the history. The study and analysis of many other memoirs were involved in the task. A systematic index, carefully prepared by Prof. Pearson, is appended.

We have received Part I (Kinematics) and Part II (Dynamics and Statics) of *An Elementary Treatise on Theoretical Mechanics*, by Prof. *Alexander Ziwet*, of the University of Michigan (Macmillan, $2.25 a volume). The work owes its existence mainly to the difficulty of finding a good modern text-book suited to the requirements of the American student. While it is intended first of all as an introduction to the science of theoretical mechanics, the author has aimed to make it serve as a preparation for the applications in engineering practice, and to bring out the utility of the purely mathematical training. To keep the whole work within reasonable bounds, the more advanced parts of the subject had to be strictly excluded. A third part (Kinetics) will complete the treatise.

The Book of the Fair, published by the Bancroft Company, Chicago and San Francisco, is intended to reproduce and preserve, by engraving and letterpress, all the characteristic features of the recent exposition at Chicago. The publishers claim that it is the only work attempting to reproduce the exposition in this way entire. "It confines itself," they say, "neither to art alone on the one side nor to dry statistics on the other, but aims to present in attractive and accurate form the whole realm of art, industry, science, and learning, as here exhibited by the nations, so far as can be done within reasonable limits." The work will consist of one thousand pages of twelve by sixteen inches, will be issued in twenty-five parts of forty pages each, at the price of a dollar a part, and will contain more than a thousand illustrations, many of them full page.

In *J. E. Mulholland's* revision of Dr. Arnold's *First and Second Latin Book and Practical Grammar* the labors of the editor have been directed, first, to the removal of all errors; second, to a change of exceptional Latin expressions, which are declared out of place in an elementary work; third, to simplicity of design, so that subjects should not be prematurely thrust upon the attention of the pupils; and, fourth, to a more consistent arrangement of the parts of the Second Book. In the revision of Arnold's *Practical Introduction to Latin Prose Composition*, by the same editor, the matter on the Sequence of Tenses, hitherto scattered throughout the work, has, by means of references, been unified, and that on Conditional Propositions has, by the removal of much verbiage and some errors, been arranged so as to be comprehensible to the ordinary student. Also, whereas in the old book reference was merely made to certain works on Synonyms, in this edition, the works quoted not being commonly in the hands of pupils, the proper word is given. (Both of these books are published by the American Book Company. Price, $1 each.)

The *Inductive Greek Primer* of Drs. *W. R. Harper* and *C. F. Castle* is designed for a beginner's Greek book and to meet the wants of younger pupils as well as of those for whom the *Method* is adapted. It differs from the *Method* in that the lessons are shorter; the notes are more copious and elementary; the exercises are simple; the pupil's knowledge of Latin grammar is drawn upon to illustrate and facilitate his knowledge of Greek grammar; the pupil is taught to read Greek in the order of the original; the first occurrence of words is specially indicated in both the text and the vocabulary. The volume articulates with the Greek Prose Composition of the same authors. (American Book Company. Price, $1.25.)

In a book entitled *The Gospel of Paul*, the author, *Charles Carroll Everett*, Professor of Philosophy in Harvard Divinity School, presents an interpretation of Paul's doctrine of the atonement which he believes to be new; not a theory of his own "of a possi-

ble scheme of atonement, to which some of Paul's words may be made to fit more or less loosely. I mean a statement which has nothing in it of my own, but which is based wholly upon an examination of the words of Paul, these being taken in their most natural and direct signification." This interpretation forced itself upon him when he first began the serious reading of the New Testament, and all his subsequent study has confirmed its truth; and while it is remote from our habits of thought, it does not, the author believes, contradict our moral sense, and he hopes it "may do something to reconcile the New Testament and the conscience of the Christian world." (Published by Houghton, Mifflin & Co. Price, $1.50.)

The edition of the *Æneid (six books) and Bucolics of Vergil* prepared by President *W. R. Harper* and Instructor *F. J. Miller* is intended to present the Latinity of the author in as suggestive and accessible a form as possible, and to afford stimulus and material for the study of the poet from a literary point of view. The plan of the studies is inductive throughout. In the Introduction are given a series of studies for developing important principles of syntax, and a new presentation of the Vergilian verse and principles of quantity. Materials for literary study are provided in a bibliography; a list of topics for investigation; an account of the Royal House of Troy; Rhetorical Study; and notes of various kinds. The Eclogues are introduced at the request of teachers who desire to give their classes more than the first six books of the Æneid. (This edition of Vergil is published by the American Book Company. Price, $1.50.)

President *W. R. Harper*, of the University of Chicago, and *James Wallace* have prepared a handsome, compact edition of Xenophon's Anabasis for class-room use, with suitable illustrations and other aids to enhance interest and facilitate the study of the noble classic. The text is that of the recension of Arnold Hug. The notes are brief and elementary, supplemented by references to the grammars and to the historical introduction which precedes the text. The first occurrence of words is indicated by special type. Great pains have been taken with the vocabulary. Guides are furnished for etymological study. Maps of Greece and of the route of the Anabasis and the retreat are inserted. Three of the books have been edited for sight-reading. Tables of paradigms are given. The Historical Introduction, Bibliography, and Itinerary are rich in information and can not but contribute much to make the story seem real. (American Book Company. Price, $1.50.)

For his book of *Logarithmic Tables*, Prof. *George William Jones*, of Cornell University, has compared the figures of the principal larger tables, and applied every known test for accuracy, computing anew where there was doubt; has sought, by similar examinations of standard tables and by consultation, to secure a plan that would promote rapid and easy use; has employed such type and adopted such arrangement as would so far as possible prevent straining of the eyes; and presents the work at the small cost of seventy-five cents. The tables are preceded by a satisfactory set of explanations, and include logarithms of numbers, trigonometric functions, addition-subtraction logarithms, prime and composite numbers, squares, cubes, square and cube roots, reciprocals, quarter-squares, Bessel's coefficients, binomial coefficients, and errors of observation. (Published by the author at Ithaca, N. Y., and by Macmillan & Co.)

PUBLICATIONS RECEIVED.

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American Book Company. The School Calendar.

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Badenoch, L. N. Romance of the Insect World. New York: Macmillan & Co. Pp. 341. $1.25.

Bell, Alexander Melville. Speech Tones. Washington, D. C. Pp. 18.

Bolin, Jakob. New York. Mental Growth through Physical Education. Pp. 18.

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Burpee, W. Atlee, Philadelphia. Selection in Seed Growing. Pp. 96.—Burpee's Farm Annuals, 1894. Pp. 178.

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Cattell, J. McKeen, and Baldwin, J. Mark. The Psychological Review. Bi-monthly. Vol. I, No. 1. Pp. 112. New York: Macmillan & Co. 75 cents; $4 a year.

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Foreman Pattern-maker, A. Helical Gears. New York: Macmillan & Co. Pp. 127. $2.

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Hectoen, Ludvig. Technique of Post-mortem Examination. Chicago: W. T. Keener Co. Pp. 172. $1.75.

Hitchcock, Romeyn. The Ancient Pit Dwellers of Yezo, Japan. Pp. 10.—The Ainos of Yezo. Pp. 75.—Shinto, or the Mythology of the Japanese. Pp. 14.—Ancient Burial Mounds of Japan. Pp. 16, with Plates.—Some Ancient Relics in Japan. Pp. 2, with Plates. All published at the United States National Museum.

Hoffmann, Charles Frederick. Christ the Pattern of all True Education. Pp. 209.—The Library of a Divine Child. Pp. 110. New York: R. & J. B. Young.

Huxley, Thomas H. Method and Results. Pp. 430.—Science and Education. Pp. 451. New York: D. Appleton & Co. $1.75 each.

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Keen, W. W., M. D., Easton, Pa. Medicine as a Career for Educated Men. Pp. 19.

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To-day. Monthly. Vol. I, No. 1. Philadelphia: F. A. Bisbee and M. Whitcomb, Editors and Publishers. Pp. 44. 10 cents; $1 a year.

University of Pennsylvania. Contributions to the Botanical Laboratory. Pp. 125, with Plates.

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POPULAR MISCELLANY.

Geological Society of America.—The sixth annual meeting of the Geological Society of America was held December 27–29, 1893, in Boston and Cambridge, Mass. The sessions of the opening and closing days were in the hall of the Boston Society of Natural History, and those of the second day were in the Harvard University Museum, Cambridge. The Geological Society has a membership of about two hundred and twenty-five, comprising most of the prominent working geologists of North America. It holds two meetings yearly, one in the summer in connection with the American Association for the Advancement of Science, and a winter meeting in the holidays following Christmas. Each of these meetings is held successively in different cities of the United States and Canada, previous winter meetings having been held in New York, Washington, Columbus, and Ottawa. The officers elected for the year 1894 are Prof. T. C. Chamberlin, of Chicago, president; Prof. N. S. Shaler, of Cambridge,

and Prof. George H. Williams, of Baltimore, vice-presidents; and Prof. H. L. Fairchild, of Rochester, N. Y., secretary. About sixty papers were presented at this meeting, a few of which are here briefly noticed:

In his address as the retiring president, Sir J. William Dawson, of Montreal, chose for his subject Some Recent Discussions in Geology, considering especially the building up and development of the continents. He noted the controversies respecting the age of the older crystalline rocks, the true foundation stones of continents, instancing those of the Highlands of Scotland as described by Geikie, and the older rocks of North America as worked out by Logan and his successors. He was inclined to think that the oldest rocks that we shall know are the gneisses of the lower Laurentian, and that these may be regarded as the igneo-aqueous products of the earliest action of the waters on the crust of a cooling globe. He then referred to the rival theories of mountain-building, and, after distinguishing between mountains of eruption (volcanoes), like Vesuvius and Cotopaxi, mountains of slightly inclined strata, like the Lebanon and the Sierra Nevada, and mountains of contorted strata, like the Alps and the Appalachians, noted the diverse views as to the origin of the latter. He favored the time-honored contraction theory as explained recently by Le Conte, but saw no objection to connecting with this the deposition theory of Hall and others, the expansion theory of Mellard Reade, and the isostatic theory of Dutton. When it is necessary to account for the compression of vast masses of rock into a third of their normal dimensions and for their elevation thousands of feet above the level of the sea, we may be thankful to invoke all available powers each in its proper place, and the sculpturing due to atmospheric agencies besides.

Prof. C. H. Hitchcock, of Hanover, N. H., spoke about Ancient Eruptive Rocks in the White Mountains. He said that in his reports of the New Hampshire Geological Survey he had described in detail a great variety of granites occurring in the White Mountains, without having discovered the principle of their association. He then reviewed the order of these varied igneous rocks and showed that the same structure found in volcanoes appeared in the White Mountains. He was therefore convinced that the granites were truly eruptive. If the modern view of the formation of granite is correct, the depth at which it is formed, as shown in the White Mountain region, is from two thousand to five thousand feet, and decidedly not forty thousand feet, as some geologists have maintained.

Prof. George H. Williams, of Johns Hopkins University, treated the subject of Ancient Volcanic Rocks along the Eastern Border of North America. He proposed to designate as volcanic only such igneous rocks as had flowed up through vents to the surface. All existing knowledge of the occurrence of these rocks during the early geologic ages in eastern North America was summarized, beginning with Newfoundland and passing southwestward along the Appalachian mountain belt.

Mr. Alexander Agassiz, Director of the Museum of Comparative Zoölogy at Harvard University, presented An Account of an Expedition to the Bahamas, which were described as formed of wave-worn and wind-blown coral sands.

Among the papers relating to the glacial drift, Prof. T. C. Chamberlin and Mr. Frank Leverett discussed Certain Features of the Past Drainage Systems of the Upper Ohio Basin, concluding that the lower portions of the rock valleys of the upper Ohio and its tributaries were eroded during an interglacial epoch. Prof. G. Frederick Wright, describing parts of the same region in a paper on the Glacial History of Western Pennsylvania, referred the valley erosion in rock almost wholly to a preglacial time of higher altitude of the country, citing the occurrence of glacial gravel deposits extending from the high terraces down to the bottom lands, and regarding the Ice age as continuous and geologically short.

The Harvard Observatory.—The beginning of the Astronomical Observatory of Harvard College is usually identified with the appointment of Prof. W. C. Bond as observer in 1840. The appearance of the first comet of 1843 excited fresh interest in the subject, and funds were collected to buy the great telescope, which then had only one match in the world, in 1847. The resources of the observatory have since been increased by various subscriptions, gifts, and bequests. The

general expenses are largely provided for from the bequests of Edward B. Phillips and Robert Treat Paine. The Henry Draper Memorial, established by Mrs. Draper, furnishes the means of studying the spectra and other physical properties of the stars. The observing station near Arequipa, Peru, 8,050 feet above the sea, was established under the bequest of Uriah A. Boyden. By maintaining a station south of the equator, work at Cambridge may be extended to the southern stars; and all important researches there are, therefore, now made to include stars in all parts of the sky, from the north to the south pole. Miss C. W. Bruce, of New York, has provided the means for a photographic telescope, which will be mounted first in Cambridge, and later in Peru. In meteorological work the observatory is associated with the Blue Hill Meteorological Observatory, the New England Meteorological Society, and the New England Weather Bureau, and provides for the publication in its annals of the results obtained by the observers of these associated stations. Meteorological stations connected with the observatory at Arequipa, Peru, are situated on Mount Chachani, 16,650 feet, and on El Misti, 19,200 feet, above the sea. Several large prisms have been procured for photographing the spectra of the stars.

Women in Postal and Railway Service.—According to the *Journal des Economistes*, France was the first country to admit women to places in the postal administration, and their engagement has proved so satisfactory that the authorities are inclined to prefer them to men wherever it is possible. In the United Kingdom, deducting the letter carriers, 25·2 per cent of the persons employed in the post offices are women. In Switzerland women are eligible equally with men for vacancies in the postal and railway departments. Many women are engaged in the telegraph and telephone departments, and the railways employ them in various capacities. In Holland only eight classes of employment in the administration of posts and telegraphs are open to women. The railways employ seven hundred and twenty women. In Italy a few women are occupied in the postal and telegraph offices. In Spain nearly all the positions in the telephone offices are held by women, and their work in the telegraph offices has been so satisfactory that the Government has decided to have more of it. In Sweden more women than men are found in the telegraph offices, and single women are admitted to all departments of the post-office service, except that of letter carriers. Women have the same salaries and equal positions in the telegraph and post offices of Norway and Denmark as men, and in Denmark may become "station masters" on the railway, while they also figure as shorthand writers in the Parliament. We find them also in public offices, on the most liberal terms that have been made, in Finland and Iceland. They occupy many positions in Germany, Austria, Roumania, Russia, and in the British colonies. The Republic of Brazil admits women to all the Government departments; the United States of Colombia has provided a class in telegraphy for them; and in Chili, besides filling places in the postal and telegraph departments, they monopolize the function of conductors on the tramways.

The Russian Village.—While the dissolution of the community of land in western Europe is of comparatively recent date, in Russia, as Mr. Isaac A. Hourwich shows in his Columbia College study of the Economics of a Russian Village, the process of evolution has been less rapid, and this primeval institution has been preserved till to-day. There is not, however, found there within historical times that tribal communism which Mr. Lewis H. Morgan met with among North American Indians. The Russian village community of historical times consists of a number of large families, often, yet not necessarily, of common ancestry, who possess the soil in common, but cultivate it by households. The ancient communal co-operation reappears sporadically, on various special occasions, in the form of the *pómoch* (or help). Some householder invites his neighbors to help him in a certain work (just as in the times of our early settlements)—to mow his meadow lot, to reap his field, to cut down wood for a new house he has undertaken to build, etc. This is regarded as a reception tendered by the family to its neighbors, and different kinds of refreshments are prepared for the occasion, which constitute the only remuneration for the work done by

the guests. Of course, there is nothing compulsory in the custom, and no one is bound to answer the call in case he does not like to do so. On the other hand, the party benefited is under an obligation to appear at the call of those who participated in the *pómoch*. This custom does not play as conspicuous a part as in former days, when rural settlements were scattered clearings in the forests, and pioneer work was constantly needed. Still, even then it was only a social revival, hinting at a preceding epoch of closer communistic co-operation, and at the same time pointing out the existing severance between the households of which the community was formed. The Russian family is not identical with the Roman family, in which the *pater-familias* was absolute master, or of any of its derivatives. It is a union of individuals having their individual rights recognized by the law, though sometimes not without certain limitations in favor of the head of the family. It is a perfect communistic commonwealth. All the movables belonging to the household, as well as its whole income, constitute the collective property of the family, but not of its head. The old Russian family resembled a community even in the number of its members. One described by Mr. Krasnoperoff numbered ninety-nine members, and was composed of a grandmother with her children and married grandchildren, all of whom were living together and working for their own common benefit. Such households, exceptions now, were universal in the past. Thus ownership of land by the community without, and complete communism within the family, were the fundamental elements in the structure of the village at the dawn of Russian history.

Chinese "Letter Shops."—According to the United States consul at Fu Chau, the Chinese Government has not yet established any post offices or postal system for the masses of the people; yet communication is easy between the people in all parts of the empire through private enterprise, which has established what are called "letter shops." Official dispatches are carried by couriers, at a rate so rapid, in cases of emergency, as from two hundred to two hundred and fifty miles a day. These official couriers are not allowed to convey private dispatches. At the treaty ports "letter shops" are used by the natives only; but in the interior, or at places not reached by the foreign postal arrangements, they are employed by foreigners as well, chiefly by missionaries. All letters and parcels to be sent may be registered and insured. When given in at a "letter shop," the contents of the envelope are displayed before it is sealed up, and stamped with the "chop" of the shop. Charges for the transmission of valuables are made on a percentage of declared value, and, as with letters, differ according to the distance to which the package is to be carried. A receipt is given, and the shopkeeper then becomes responsible either for its safe delivery, with unbroken "chop" or seal, at its destination, or for its return to the sender. In some parts of the empire about two thirds of the expenses of transmission are paid by the sender, while the remainder is collected from the receiver; thus the shop is secured against entire loss from transient customers, and the sender has some guarantee that his letter will be carried with dispatch. There are said to be nearly two hundred letter shops in Shanghai, but in many remote villages there are none.

Protection of Birds' Eggs.—A short discussion took place in the British Association concerning the best method of protecting birds' eggs. In presenting the report of the committee on the subject, Dr. Vachell said that, while everybody agreed that eggs should be protected, serious differences of opinion prevailed as to the way in which the object should be reached. Some thought the taking of particular eggs in particular places should be prevented at particular times of the year. Against this, it had been found impossible, on account of resemblances, to prove in court the specific identity of many kinds of eggs. It had therefore been suggested, as a better plan, to protect the special areas in which particular species were found to be declining. The question was asked, What was to be done with the little boy ten years old who might be tempted to rob a nest? Was he to be sent to jail? Mr. Walter found bird-nesting an intolerable nuisance, eggs being collected, not for scientific purposes, but simply to ornament rooms. Mr. M. S. Pemberry argued that many boys

began a study of natural history by the collection of eggs. Mr. Milne Redhead did not think the act of bird-nesting the greatest evil, but the collection of eggs for sale in large towns. Prof. Newton spoke of the practical impossibility of convicting bird-nesters on account of the difficulty of distinguishing between the eggs of one species and those of another.

Various Speeds.—The horse, said Mr. Jeremiah Head, in a paper recently read, though he could not walk faster than man, nor exceed him in jumping heights or distances, could certainly beat him altogether when galloping or trotting. A mile had been galloped in one hundred and three seconds, equal to thirty-five miles per hour, and had been trotted in one hundred and twenty-four seconds, equal to twenty-nine miles per hour. How man's position as a competitor with other animals in speed was affected by his use of mechanical aids, but without any extraneous motive power, was considered in reference to locomotion on land, in water, and in air. But the most wonderful increase in the locomotive power of man on land was obtained by the use of the modern cycle. One mile had been cycled at the rate of 27·1 miles per hour, fifty at twenty, one hundred at 16·6, three hundred and eighty-eight at 12·5, and nine hundred at 12·43 miles per hour. Unaided by mechanism man had shown himself able to swim for short distances at the rate of three, and long distances (twenty-two miles) at the rate of one mile per hour. He had also given instances of being able to remain under water for four and a half minutes. Credible eye-witnesses stated that porpoises easily overtook and kept pace with a steamer going twelve and a half knots, or, say, over fourteen miles an hour, for an indefinite length of time. This was five and fifteen times the maximum swimming speed of a man for short and long distances respectively.

Tendencies of Population.—In a paper read in the British Association, Mr. E. Cannan, of Oxford, sought to show that, contrary to the general belief that the population of the great towns is being increased almost as much by immigration as by excess of births over deaths, the excess of immigrants over emigrants, or net immigration, is rapidly diminishing, and seems likely to disappear before the end of the century. The net immigration into London in the last ten years was only fifty-six per cent of what it was in the previous ten years, and only sixty-three per cent of what it was thirty years before, when the population was two and a half millions less than it is now. In this matter London is by no means in advance of the other great towns. In Liverpool the net immigration was 68,000 in 1851 to 1860, 56,000 in 1861 to 1870, 49,000 in 1871 to 1880, but in 1881 to 1890 the balance was the other way, and there was a net emigration of 15,000. In the case of Manchester the decline of the net immigration was neither so continuous nor so great as in Liverpool, but it was considerable. In each of the first two decades it was about 32,000, then it rose to nearly 50,000, but in the last decade it has declined to 17,700. The three great Yorkshire towns, Leeds, Sheffield, and Bradford, showed considerable fluctuations. Into the three taken together the net immigration was 25,000 in 1851 to 1860; in 1861 to 1870 it made an enormous jump up to 78,000, and then dropped right down to 18,000 in 1881 to 1890. The net immigration into the towns was affected by migration between the towns and other countries as well as by migration between the towns and the rest of England and Wales.

Animal and Artificial Mechanism.—Comparing animal mechanism with artificial, Mr. Jeremiah Head said, in his sectional address at the British Association, that all animals were in their bodily frames, and in the intricate processes and functions which went on continuously therein, mechanisms of so elaborate a kind that we could only look and wonder and strive to imitate them a little here and there. The mechanical nomenclature of all languages was largely derived from the bodies of men and other animals. Many of our principal mechanical devices had pre-existed in them. Mr. Head proceeded to consider how far man was in his natural condition, and had become by the aid of mechanical science, able to compete successfully with other and specially endowed animals, each in his own sphere of action. The bodily frame of man was adapted for life and movement

only on or near to the surface of the earth. Without mechanical aids he could walk for several hours at a speed which was ordinarily from three to four miles per hour. Under exceptional circumstances he had accomplished over eight miles in one hour, and an average of two and three quarter miles per hour for a hundred and forty-one hours. In running he had covered about eleven and a half miles in an hour. The power of the living human mechanism to withstand widely diverse and excessive strains was altogether unapproachable in artificial constructions. Thus, although fitted for an external atmospheric pressure of about fifteen pounds per square inch, he had been able, as exemplified by Messrs. Glaisher and Coxwell in 1862, to ascend to a height of seven miles and breathe air at a pressure of only three and a half pounds per square inch, and still live. And, on the other hand, divers had been down eighty feet deep, entailing an extra pressure of about thirty-six pounds per square inch, and had returned safely. One had even been to a depth of one hundred and fifty feet, but the resulting pressure of sixty-seven pounds per square inch cost him his life. No animal burrowed downward into the earth to a greater depth than eight feet, and then only in dry ground.

The Phillips Prize Essay Fund.—The Herbert M. Phillips prize essay fund of five thousand dollars of the American Philosophical Society was founded by Miss Emily Phillips in memory of her deceased brother, who was an honored member of the society. Its purpose is the provision of prizes, to be awarded from time to time from the income of the fund, for the best essay of real merit on the science and philosophy of jurisprudence. In pursuance of the conditions of its establishment, a prize is now offered by the society, to be awarded during 1895, of five hundred dollars lawful gold coin for the best essay on either of the following subjects: 1. The sources, formation, and development of what is generally designated the common law of England. 2. The theory of the state, treated historically, and upon principle, with a discussion of the various schools of classical, mediæval, and modern thought upon the subject. 3. The historical and doctrinal relations of the Roman law and the English law, illustrated by parallels and contrasts. The essays of competitors should be in possession of the society before the first day of January, 1895, and should be sent addressed to Frederick Fraley, president of the society.

Oxygen as a Remedy for Choke Damp.—A committee appointed at the Edinburgh meeting of the British Association, 1892, to determine whether oxygen gas was useful as a restorative in cases of carbonic-acid poisoning, and particularly in those of choke-damp asphyxia in mines, reported to the recent meeting its conclusions, from experiments on rabbits, that oxygen was of no greater service than air. It suggested, however, that the experiment of keeping a few cylinders of air with nose and mouth pieces ready for use in those parts of the workings where men could be most easily imprisoned might be attended with valuable results. It seemed quite reasonable that where a person had to be dragged long distances through a contaminated atmosphere the chances of ultimate recovery would be greater if the effects of this poisonous atmosphere were neutralized at the commencement and during the progress of the work of rescue than if no such attempt were made until fresh air was reached in the ordinary way.

Isolation of Fluorine.—A demonstration of the isolation of fluorine was made before the British Association by Dr. Meslans, the representative of the French chemist, M. H. Moissan. The apparatus employed consists entirely of platinum and fluorspar. A powerful current of electricity is passed between platinum electrodes through anhydrous liquid hydrogen fluoride mixed with one of its salts, and cooled to a very low temperature by means of methyl chloride. Under these conditions fluorine is given off from one of the electrodes, and hydrogen gas from the other. The fluorine is an almost colorless gas, and its presence is made evident by its action on various compounds. Crystallized silicon, amorphous boron, phosphorus, sulphur, alcohol, and various metals take fire at the ordinary temperature and burn brilliantly in a current of the gas. These phenomena were exhibited to the section, and the demonstration was in every way success-

ful. Sir Henry Roscoe moved a vote of thanks to M. Moissan and M. Meslans. The vote, he said, must be regarded as coming from the whole Association and not simply from the Chemical Section. Prof. T. E. Thorpe seconded the motion, which was carried with loud cheers, and the president of the section, Dr. Emerson Reynolds, sent a telegram to M. Moissan congratulating him, on behalf of the section, on the great success of the demonstration.

Bacteriology in Chemistry.—Bacteriology, said Prof. Frankland, opening the discussion of that subject in the British Association, although originally an offshoot of botany, received its great impulse from the association with chemistry which began with the researches of Pasteur, while the greater part of our more recent knowledge was due to the labors of those medical men who had followed in the steps of Koch and his pupils. The progress that has been made of late years in this line of research was mainly due to the methods of producing pure and selective cultivations. These methods did not at present seem capable of any great modification, and a knowledge of them might be regarded as essential in a really liberal education. Pure cultivations of yeasts were now articles of commerce, and pure cultivations of microbes for purposes of research could be obtained in the same manner as pure chemicals. Bacteria, whose properties had been modified by successive cultivations, are also supplied in quantities for the preventive inoculation of cattle. Later work had shown that the differentiation of even the most carefully studied bacteria, such as those of cholera and typhoid, was very difficult, and the morphological characteristics which were originally employed almost exclusively had given way to chemical and pathogenic tests. Individuals of the same bacterium under different conditions will show greater variations than are shown by different species. The fermentations produced by bacteria, as distinct from those produced by yeasts, were of constantly increasing importance, and had afforded means of splitting up certain compounds and isolating new products that could not be obtained in any other way. The compounds fermentable in this way belonged to a very few chemical groups, and the products of the change were few in number and comparatively simple in character. It would seem that while the same compound might yield different products when acted upon by different organisms, one and the same organism would yield the same products even when it acted on substances of very different composition. By reason of their selective action and their tendency to attack certain compounds in preference to others in the same liquid, bacteria enabled us to separate substances of identical chemical composition but different physical properties which could not as yet be separated in any other way.

Arctic Rivers.—The rivers which flow into the Arctic Ocean, said Mr. Henry Seebohm in the British Association, are some of them among the greatest in the world. Some idea of the relative sizes of the drainage areas of a few of the best-known rivers may be learned from the following, in which the Thames, with a drainage area of 6,000 square miles, is the unit: Nine Thames equal one Elbe (54,000); two Elbes equal one Pechora (108,000); two and a half Pechoras equal one Danube (270,000); two Danubes equal one Mackenzie (540,000); two Mackenzies equal one Yenisei (1,080,000); two Yeniseis equal one Amazon (2,160,000). There is nothing that makes a greater impression upon the arctic traveler than the enormous width of the rivers. The Pechora is only a river of the fifth magnitude, but it is more than a mile wide for several hundred miles of its course. The Yenisei is more than three miles wide for at least a thousand miles and a mile wide for nearly another thousand. Whymper describes the Yukon as varying from one to four miles in width for three or four hundred miles of its length. The Mackenzie is described as averaging a mile in width for more than a thousand miles, with occasional expansions for long distances to twice that size.

Investigation of Earthquake Phenomena.—The committee of the British Association, appointed to investigate the volcanic and earthquake phenomena of Japan, has reported that the records of horizontal pen-

dulum motions during the past ten years show that the earth tremors of Japan have no direct relation to its earthquakes. Records of both have been kept. A well-marked periodic tilt of the land has been detected, corresponding to a rise of the land on the northeast side, and a more rapid subsidence of it again. Similar effects had been recorded in Germany, but of much smaller amplitude. In Germany, barometric changes caused the tilting, but the relation between the two was not so marked in Japan; there may possibly, however, be some connection of them with magnetic influences. The directions of earthquake motions and of earth tremors across Japan were each at right angles to the mountain axis of the country, a fact which suggests that both are caused by crumpling of the mountains round their axis. The observations of earth tremors had gone so far as to demand attention from practical astronomers and others. When a tremor occurred it rendered delicate weighing impossible, inasmuch as the balance swung irregularly and altered its zero. Similarly astronomical observations would be upset. A practical outcome of the committee's reports was the alteration in the design of bridges in Japan. After earthquakes it was found that bridges and other masonry gave way at the base; the form of a wall or pier had been calculated which, on being subjected to a horizontal reciprocating medium, would be equally likely to break at any part.

Mount Tacoma.—An effort is making by the citizens of Tacoma, Washington, to restore to their lofty and graceful mountain—to which the name Rainier has been attached—its aboriginal designation of Tacoma. This term, according to the analysis of it by the Hon. James Wickersham, quoted in F. G. Plummer's Illustrated Guide Book, means "snow-covered mountain." The mountain is in full view from the city of Tacoma, bearing south, 56° east, a distance of forty-four miles. It stands about twelve miles west of the Cascade Range, and its entire drainage flows westward into Puget Sound and the Columbia River. It "has the form of a dome surmounted by three small peaks, with a maximum elevation of fifteen thousand feet. It rises almost from the sea-level; and as its average diameter at the base is about twenty miles, its mass is roughly estimated at two hundred cubic miles. Upon its slopes on every side are enormous glaciers and ice-fields, arranged on radial lines and forming a system that for extent and grandeur is unexcelled on the earth. The limit of perpetual snow is at four thousand feet, but the timber line extends much higher. Natural groves, meadows, and prairies surround the mountain, except where the river cañons and glaciers cut the slopes. Upon the northeast the Urania, Blaine, Inter, and Winthrop glaciers drain into White River and thence to Duwamish Bay. To the northeast the Carbon, Willis, North Mowich, South Mowich, and Pugallup glaciers form the Pugallup River, which flows to Tacoma harbor. To the southwest the Tahoma, Kautz, Van Trump, Nisqually, and Paradise glaciers drain into the Nisqually River, which flows through Succotash Valley to Puget Sound. The Cowlitz River is the drainage from the Cowlitz, Willinakas, and Little Willinakas glaciers, and flows into the Columbia River." The mountain is reached from Tacoma by electric railway, eleven miles to Lake Park, stages to Paradise Park, sixty-seven miles from the city, and thence by a day's hard work climbing nine thousand feet up in seven miles. Mr. Plummer's Guide Book (Tacoma, Wash.) is full of information about the mountain, clearly and precisely given.

Dr. Alfred L. Carroll.—Dr. Alfred Ludlow Carroll, of New York, who died October 30, 1893, was a physician of high standing, a vigorous writer on subjects of medicine, sanitation, and hygiene, and an active laborer for the elevation of the standards of medical science and practice and the diffusion of sound principles of hygiene. A full sketch of his life has been prepared by Dr. J. W. S. Gouley for the New York State Medical Association, from the advance sheets of which, kindly furnished us by him, we gather that he was born in New York city, August 3, 1833, the son of parents of good scholarship and refined tastes. He began the study of his profession when eighteen years of age, with Dr. Valentine Mott, expecting to become a surgeon, but afterward turned his attention to general medicine. He began to contribute to the med-

ical press in 1857, and wrote many papers and editorial articles for several journals; and from 1867 to 1871 edited the Medical Gazette. As editor he "labored industriously to raise the standard of medical morals and of scientific essays. His reviews of literary and scientific works are so many pleas for thoroughness in research, accuracy in statement, simplicity in diction, and good taste in composition. . . . His dislike of shams and of irrational methods is exhibited throughout his essays, both medical and literary, in verse and in prose." With his other qualities he had a keen wit, which was used to good effect in his writings, and in drawings and models satirizing follies, abuses, exaggeration in fashions, and hygienic improprieties. Retiring from the editorship of the Medical Gazette in 1871, he settled for practice in New Brighton, Staten Island, till 1889, when he removed to New York city. He was a member of the Council of the New York State Medical Association, and for three years edited its transactions. His most important work was performed in sanitary science. Dr. Gouley names thirty-seven editorial articles on public health, which he published while editor of the Medical Gazette. He wrote for the World a series of articles—the Ollapod Papers—on hygiene, conveying useful information respecting the prevention of disease and the general care of the person, which were widely read. During his residence in New Brighton he gave a series of free popular lectures on hygiene. His address on the Philosophy of Health before the Alumni Association of the University Medical College of New York, and those on Public Health before the New York State Medical Association in 1885, and the American Medical Association in 1890 were of high character. In 1884 he became Secretary of the New York State Board of Health, succeeding Dr. Elisha Harris, deceased. In this position he was much consulted with reference to health laws and general sanitation. While in this office he delivered an acceptable course of lectures on hygiene at the Albany Medical College; and he gave courses on the same subject at the Mott Memorial Hall in 1890, and at the New York College of Veterinary Surgeons in 1891. Dr. Thudicum, of London, speaks of his later writings, with which only he is acquainted, as "full of original observations, keen application of the most progressive science, and conclusions of the greatest practical value."

Cheating Ancestors and Gods.—A curious industry in some of the provinces of China is the manufacture of mock money for offering to the dead. Formerly sham paper money was burned, but now mock dollars are used. They are only half the size of real dollars, but the dead are supposed not to know the difference; and, moreover, there is no more harm in cheating the dead than there is in cheating the living. To make them, tin, hammered out till it is not thicker than the thickest paper, is punched to the size of half dollars and pasted on disks of cardboard. A boy then takes the pieces, and with two dies, one representing the one side and the other the reverse, hammers impressions of dollars upon them, and the money is ready for use. Some districts of the Anhui province having been ravaged by an epidemic, so that in many places the people were not able to attend to the harvesting of the crops, an attempt was made to deceive the gods by playing at New-Year's day. Every preparation—burning fire-crackers and pasting happy sentences in red paper on the doors, and the rest—was made for celebrating the bogus New Year. The object was to make the god of sickness think he had made a mistake in the seasons, and had erred in bringing an epidemic on the people at a time when, in the course of Nature, no epidemic should appear. As any action contrary to Nature done by the gods is liable to punishment by the King of Heaven, the actors in this farce thought that the god of sickness would gather his evil spirits back to him for fear of the displeasure of his superior divinity. This child's play received the permission and co-operation of the local authorities.

The Future of Geographical Exploration.—In his recent annual address as President of the Royal Geographical Society, Mr. Clements R. Markham said that the work of geographical discovery during living memory had proceeded with such rapidity that many had been half inclined to think that there was little left to be done. There were still wide tracts, however, in all the great divisions

of the earth, which were unknown to us and which would furnish work to explorers for many years to come; while the examination of ocean depths was an important task which had but lately been begun. Moreover, there were regions of vast extent which were only very partially known to us, the more detailed examination of which would enable explorers to collect geographical information of the highest value and of the greatest interest. It was from the methodical study of limited areas that science derived the most satisfactory results. When such investigations were begun it was found how meager and inaccurate previous knowledge, derived from the cursory information picked up during some rapid march, had been. A detailed scientific monograph on a little-known region of comparatively small extent supplied work of absorbing interest to the explorer, while he had the satisfaction of knowing that his labors would be of lasting value and utility. There was sufficient work of this less ambitious but not less serviceable kind to occupy a whole army of field geographers for many decades. Exact delineation by trigonometrical measurement was their work. It was hardly begun. With the exception of countries in Europe, British India, the coast of the United States and a small part of its interior, the whole world was still unmapped.

NOTES.

THREE lectures for young people were delivered in January in behalf of the Royal Geographical Society, by Douglas Freshfield, President of the Alpine Club, on Mountains. The special subjects were a brief general description of the structure and features of a mountain region; the steps by which the High Alps have gradually been discovered, conquered, and converted to human uses; and the lecturer's special field of exploration, the Caucasus.

As many as a hundred and thirty papers were read in the Meteorological Congress, in Chicago, in August, 1893. The congress was divided into nine sections: A, Prof. C. A. Schult and H. H. Clayton presiding, discussing instruments and methods of observation, especially methods of observing in the upper air; B, Prof. Cleveland Abbe, president, dealing with questions of meteorological dynamics, including thunder-storm phenomena; C, Prof. F. E. Nipher presiding, climatology; D, Major H. C. Dunwoody, president, the relation of climate to plant and animal life; E, Lieutenant W. H. Beehler, marine meteorology, ocean storms and their prediction, methods of observation at sea, and international co-operation; F, Prof. Charles Carpmel and A. Lawrence Rotch, improvement of weather service, and especially the progress of weather forecasting; G, Prof. F. H. Bigelow, problems of atmospheric electricity and terrestrial magnetism; H, Prof. Thomas Russell, rivers and the prediction of floods; I, Oliver L. Fassig, history and bibliography.

THE name of the Chinook wind is taken, according to H. M. Ballou, from that of the Chinook Indians, near Puget Sound. During the prevalence of the wind the thermometer rises in a few hours from below zero to 40° or 45°. It is analogous to the Fohn of Switzerland, and similar winds are reported from various parts of the world. All that is needed to produce them are high and low pressure areas, whereby the air is caused to pass over the mountains, depositing its moisture on the ascent, and descending on the leeward side.

STRIKES, it appears, are not a modern innovation, but were known centuries ago, with outcomes as disastrous as those of the present. In the year 1329 a strike of brassworkers was begun in Breslau, Silesia, which lasted a year. Fifty-six years later, in 1385, one of blacksmiths took place in Dantzic, which ended when the local authorities obtained permission to issue an edict proclaiming that until further notice any workman refusing to obey the lawful dictates of his employer as to continuing operations was to be summarily deprived of his ears.

THE English National Society for the Employment of Epileptics has bought an estate in every way desirable for a proposed colony of epileptics, and is collecting means to fit it up and set the colony in operation. It will enjoy the guidance of the experience of Germany, where an epileptic colony has been in existence at Bielefeld for twenty-six years with very encouraging results, and has now more than eleven hundred epileptic inhabitants on an area of four hundred acres. The plan of the English society is to give the colony as little as possible the character of an institution. The houses will be small, as in Germany, and the inmates of each will form a separate family. The industries will be market gardening, cow-keeping, dairy work, poultry farming, and other similar occupations, besides various trades and handicrafts. The women, who will be accommodated on a separate part of the estate, will be engaged principally in laundry work, sewing, cooking, and domestic service. The children will be suitably educated and trained to various industries.

THE powers of certain miraculous curative places apparently do not extend to all

diseases. W. R. Le Fanu, in his Seventy Years of Irish Life, gives the following testimony of an invalid who had sought the benefits of Knock Chapel: "Indeed, sir, I took all the rounds and said all the prayers, but it was of no use; not but what it's a grand place. It would astonish you to see all the sticks and crutches hanging up there —left behind by poor cripples who went home cured. It's my opinion, sir, that for rheumatism, and the like of that, it's a grand place entirely; but as for the liver, it's not worth a d—n."

THE third session of the School of Applied Ethics will be held at Plymouth, Mass., in July and August, 1894. Lectures will be given by leading scholars in three departments, namely: those of Ethics, under the direction of Prof. Felix Adler; Economics, Prof. H. C. Adams, director; and History of Religions, Prof. C. H. Toy, director. A complete programme of the lectures is to be issued. S. Burns Weston, Secretary, 118 South Twelfth Street, Philadelphia.

OBITUARY NOTES.

FRANK BOLLES, Secretary of Harvard University and an esteemed contributor to The Popular Science Monthly, died at his home in Cambridge, Mass., of pneumonia, January 10th, in his thirty-eighth year. His father was the first editor of the Boston Journal, and was distinguished in public life; his mother was a sister of General John A. Dix. He was a graduate of the Columbia and the Harvard Law Schools; had considerable experience in journalistic work; contributed to literary periodicals under the signature of "Eugene Raleigh"; was a hard worker over books, and was enthusiastically fond of outdoor life and the study of Nature in all her aspects, making specialties of mountains and birds. A few years ago he bought an abandoned farm, on the edge of Chocorua Lake and at the foot of the mountain of that name, where, as he told a gentleman who called on him last summer, he spent "every minute" he could spare from his duties at Cambridge, and where he kept his pet owls and mice, etc., in summer, wintering them at Cambridge. He contributed to The Popular Science Monthly an article on Ways of the Owl, published in June, 1892, and other articles which will appear in time; published two books, describing his outdoor and mountain excursions and studies, entitled The Land of the Lingering Snow and To the North of Bear Camp Water, and was the author, besides, of some books of information concerning Harvard University, the Genealogy of the Family of Anthony Dix, Important English Statutes, and an essay on International Arbitration, which secured him the Bowdoin prize at Harvard. As Secretary of Harvard University he kept the interests of the students at heart, established an employment bureau for them, and was beloved by them.

THE Rev. Samuel Lockwood, Ph. D., who died at Freehold, N. J., January 9th, aged seventy-five years, was well known by his popular articles on scientific subjects, which he invested with a rare charm of sympathetic interest. He was a close observer, particularly of animals in their various moods, and his descriptions were always picturesque, while accurate. He contributed sixteen articles to The Popular Science Monthly, beginning with the first volume. The subjects were: Crabs, Audubon's Lily, the Coatimondi, Cultivating Wild Flowers, The Enemies we Import, The Eucalyptus, Glass Sponges, The Great Cemetery in Colorado, A Mastodon, Musical Mice, The Oyster, American Owls, Scratching in the Animal Kingdom, and Sea Anemones.

MR. ROBERT BENTLEY, of Earl's Court, an eminent English botanist, died in December, 1893. Soon after becoming a member of the College of Surgeons, in 1847, he was appointed lecturer on botany in the Medical School of the London Hospital, and Professor of Botany in King's College. His subsequent life was entirely devoted to the advancement of botanical science, and he was the author of numerous books and papers bearing upon it, and upon the application of botanical knowledge to medicine and in the arts. One of the last of his works of this kind was the editing jointly with Profs. Redwood and Attfield of the British Pharmacopœia of 1885, which is still the official standard for all medicinal preparations required by the Medical Council.

T. W. KENNARD, C. E., founder of the Monmouthshire Crumlin Works, Wales, and designer and constructor of the Crumlin Viaduct, who died in September, 1893, was the engineer-in-chief of the Atlantic and Great Western Railway in the United States.

REAR-ADMIRAL MARIN H. JANSEN, of the Royal Netherlands Navy, died at the Hague, September 9, 1893, on the last day of his seventy-seventh year. He was largely engaged during his active life in geographical exploration and surveying; was a correspondent of Lieutenant M. F. Maury, of the United States, in his scientific work; contributed much information in aid of his researches, and published a translation of his Physical Geography of the Sea, with valuable appendices on land and sea breezes in the tropics and on ozone, which Maury incorporated into his own subsequent editions; published an important work, in 1864, on The Latest Discoveries in Maritime Affairs; was the chief promoter of the revival of arctic exploration in Holland; and contributed other valuable services to science. He was an honorary corresponding member of the British Royal Geographical Society.